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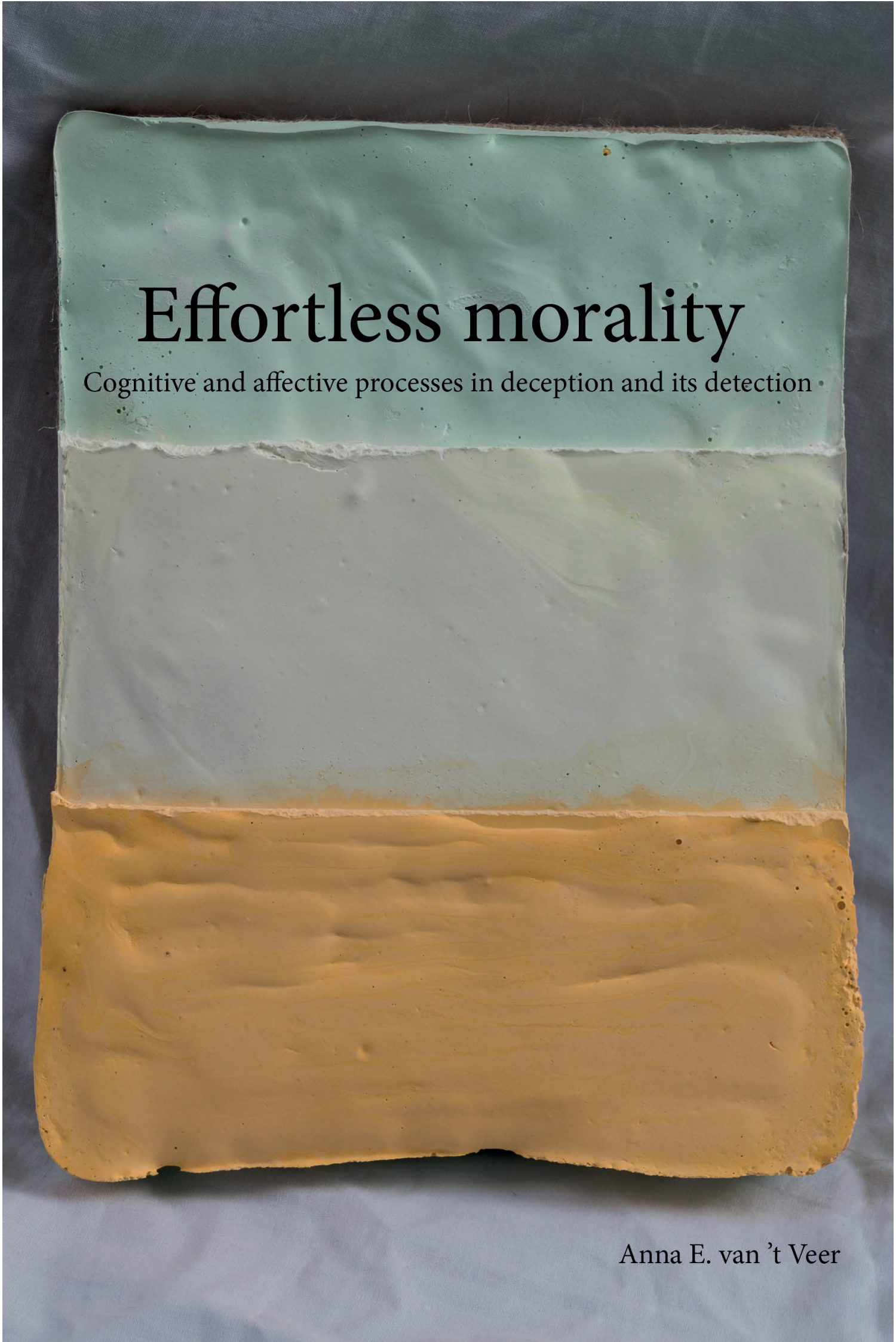
Effortless morality
Cognitive and affective processes in deception and its detection
Anna E. van 't Veer

Effortless morality

Uitnodiging
voor het bijwonen
van de promotie van
Anna E. van 't Veer

Op woensdag
20 januari 2016
om 14:00 uur in
de aula van de
Universiteit van
Tilburg

Paranimfen
Willem Sleegers
Iris Schneider
Lotte Veenstra

Effortless morality — cognitive and affective processes in deception and its detection

Anna E. van ’t Veer

Effortless Morality

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Effortless morality — cognitive and affective processes in deception and its detection

PROEFSCHRIFT
ter verkrijging van de graad van doctor
aan Tilburg University
op gezag van de rector magnificus,
prof. dr. E.H.L. Aarts,

in het openbaar te verdedigen
ten overstaan van een door het college
voor promoties aangewezen commissie
in de aula van de Universiteit
op woensdag 20 januari 2016 om 14.15 uur

door Anna Elisabeth van ’t Veer,
geboren op 13 september 1986
te Leiden

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Effortless morality

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Introduction

Chapter 1: Introduction

Our morality defines us; it is a compass to the social world. Within the moral domain, deception is one of the most telling phenomena. Lies are told on a daily basis, and deducing the trustworthiness of the intentions of others is a fundamental aspect of social interactions. Research on the cognitive and affective underpinnings of moral behavior and its detection has drastically increased in the past years. For example, researchers debate whether people are intuitively cooperative (Martinsson, Ove, Myrseth, & Wollbrant, 2014; Rand, Greene, & Nowak, 2013; Tinghög et al., 2013) and whether moral virtues can be accurately read from the face (Porter, England, Juodis, ten Brinke, & Wilson, 2008; Todorov, 2008). In this dissertation, I contribute to these debates by examining deception and deception detection through a novel lens—one that stresses the importance of the amount of cognitive effort involved. In other words, this dissertation presents an exploration of different elements that together make up a deceptive interaction. Both the deceiver and the deceived are the object of investigation: Does telling a lie require cognitive effort? And, do people perceive deception in others effortlessly?

As a basis of this exploration, I borrow from an often used analogy of two modes of cognitive function: one that is effortless, fast and automatic, and one that is effortful, slow, and deliberate (Evans, 2008; Kahneman, 2003). In contrast to research that has focused on effortful rational and instrumental considerations that lead to a judgment or a decision, the current research does not presuppose the amount of cognitive effort needed for such considerations. Rather, in the current research I take into account varying amounts of cognitive effort underlying both the decision to tell a lie, and judgments of whether another person is lying. On the deceiver's end, the amount of cognitive capacity that is available can affect whether people behave honest or dishonest. In order to examine whether being honest or dishonest is more effortful, it is therefore important to observe behavior under circumstances of limited cognitive capacity. On the receiving end of deception, the amount of cognitive effort that is expended can affect whether (dis)honesty is correctly detected.

Because previous research has indicated that deliberately made detection efforts are not very accurate, I stress the importance of looking at less effortful processes involved in detecting deception.

The above-mentioned modes of cognitive function are not a strict dichotomy (see Keren & Schul, 2009). For instance, some processes are conscious, yet require little effort. For this reason, in this dissertation I examine conscious yet automatic as well as unconscious reactions towards (dis)honesty. I do so by assessing both affective indirect judgments of veracity and physiological responses within the observer of (dis)honesty. Although I refer to these processes as being effortless, it should be noted that this does not mean that there is no processing going on—in fact, affective unconscious processing has been characterized as effortless yet capable of integrating many pieces of information (e.g., Betsch, Plessner, Schwieren, & Gutig, 2001; Rousselet, & Thorpe, & Fabre-Thorpe, 2004; Shiffrin & Schneider, 1977; Zajonc, 1980). Instead, by characterizing these processes as effortless, I emphasize that a response is not a result of deliberate conscious processing.

Below I give a brief overview of the literature that has served as a starting point for the lens through which I examine deception. This lens is focused on a reoccurring theme: Effortless operations of honesty. Importantly, this lens is applied to both the deceiver as well as the deceived.

Effortless honesty

According to diary studies, lies are told on a daily basis (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). This means people often intentionally make a statement they believe to be false. When people decide to tell a lie, their minds may be divided by opposing forces: gain something from lying, or forego this gain and keep an honest self-view. People are generally averse to lying (Gneezy, 2005). However, it seems that they are more accepting of lies that are told for the benefit of others instead of for the benefit of the liar, and that people are more accepting of lies that they themselves tell compared to the lies somebody else tells (see

supplemental material, Study 1 and 2)[1]. People often behave dishonest enough to be able to still profit from it, but not to the extent that this behavior is no longer justifiable (Mazar, Amir, & Ariely, 2008). This dishonesty could be an automatic tendency—something that people do without giving it much thought. Another possibility is that being honest takes less effort than being dishonest, and that only after some effortful deliberation (and possibly, justification) people decide to be dishonest.

Previous research that has attempted to answer the question whether being honest or dishonest is a more automatic tendency has resulted in mixed findings. On the one hand, findings suggest that intuition, compared with deliberation, results in honest behavior (Zhong, 2011). On the other hand, studies find that imposing time pressure—a manipulation thought to undermine deliberation—results in dishonest behavior (Gunia, Wang, Huang, Wang, & Murnighan, 2012; Shalvi, Eldar, & Bereby-Meyer, 2012). These latter studies focus on the amount of time as an indication of the amount of reflective thinking. However, in these studies, it is unclear whether reflection could have already taken place before, or even during, the time pressure manipulation. Taking an approach that focuses on cognitive effort, therefore, can shed more light on this question.

There are several indications from other research areas that suggests that lying is more effortful than telling the truth. For instance, evolutionary (Byrne & Corp, 2004), developmental (Hala & Russell, 2001), as well as cognitive and neuroscience research (Spence et al., 2004) suggests that lying involves complex mental processes. For instance, neuroimaging studies show that lies elicit more activation in the brain than truths (Ganis, Kosslyn, Stose, Thomson, & Yurgelun-Todd, 2003; Langleben et al., 2002; Lee et al., 2009). Nevertheless, an association—however consistent—between neural activity and deception is not sufficient to conclude that this neural activity is the cause of deception. A way to establish stronger support for a causal relationship is to interfere with the mental process. One aim of this

[1] See also van 't Veer & Stel (2014). Deception, attitudes toward. In Levine, T. R. (2014). *Encyclopedia of Deception.* SAGE Publications.

dissertation is to do exactly that. In the analogy of the two modes of cognitive function, I examine whether lying or telling the truth is the 'effortless' response.

Effortless impressions of honesty

The ease with which the truth is told can reflect itself in how a message is conveyed, just as the effort that it takes to be dishonest may give this dishonesty away. A good example of this comes from early investigations of emotional facial expressions. When Darwin showed people photographs—made by Duchenne—of a faked smile, it was clear to these people that this expression was not natural (Darwin, 1872/1998). In honor of Duchenne, Ekman (1989) suggested that the smiles that include the hard to fake contraction of the muscles around the eyes would be called 'Duchenne smiles'. Since then, research has confirmed that the Duchenne smile is a sign of true enjoyment (Ekman, Davidson, & Friesen, 1990). To observers, these spontaneous Duchenne smiles come across more genuine than non-Duchenne smiles, and this difference is most pronounced when observers are judging the smiles in dynamic (i.e., video) rather than static (i.e., picture) form (Krumhuber & Manstead, 2009).

An impression of others "develops effortlessly" (Asch, 1946, p. 275). People have a first impulse—an intuition that can either be trusted or that they can choose to overwrite. First impulses are there for a good reason. Because it takes effort to calculate all alternatives, it would be maladaptive to consciously decide what to do or think next all the time. Instead, people are equipped to make very quick and automatic assessments of stimuli in their surroundings. Intuitions that seem to arise without a cause form a basis from which conscious judgments arise. Sometimes these judgments can be difficult to explain or defend (Haidt, 2001). Similarly, it would be very effortful to consciously run through all the reasons why another person may be trusted or not: Were they honest in the past? Did they have an incentive to be dishonest in this case? Would I lie in this case? Relying on an automatically formed impression of the other person would undoubtedly be more efficient.

Indeed, it has been argued that people make judgments of the trustworthiness of others almost effortlessly. From an evolutionary perspective, this may be beneficial (Fiske, Cuddy, & Glick, 2007), as people who know how to assess trustworthiness of others would have more success in cooperating and forming coalitions with others who reciprocate when help is needed. Evolutionary accounts assert that people have an inborn module to detect cheaters, which is presumed to operate automatically (Cosmides, Barrett, & Tooby, 2010). In line with this, trustworthiness detection from faces presented in a still picture has been found to be automatic and fast (Bonnefon, et al., 2013; Todorov, Pakrashi, & Oosterhof, 2009; Todorov, 2008; Willis & Todorov, 2006; Winston, Strange, O'Doherty, & Dolan, 2002; Yang, Qi, Ding, & Song, 2011). Facial features may be an indication of character traits, but from situation to situation, a given person may be honest or dishonest. Demeanor in the situation, instead of stable facial features, may 'leak' information about dishonesty (Ekman & Friesen, 1969). Meta-analyses show that there is not one single cue that can be reliably used to spot deception (DePaulo et al., 2003). Instead, a combination of different aspects of a person's demeanor might very well be the basis of an effortless impression formed in the observer.

In order to tap into people's abilities to automatically and accurately assess others, it is therefore important to study these abilities with the use of dynamic, rather than static, information about the other person. When detecting another person's (dis)honest intent from this rich information, effortless impressions may outperform the more traditionally used explicit, deliberated judgments of veracity. In other words, as it may be too much to take in all the relevant information consciously, correct detection can benefit from unconscious processing. In the remaining chapters, I tested theoretical notions about people's ability to effortlessly form a correct impression of another person in the realm of deception detection. Specifically, I investigated people's impressions of trustworthiness and likability (i.e., warmth; Fiske et al., 2007) as well as their physiological responses when presented with dynamic information of liars and truth-tellers.

Effortless indirect judgments of honesty

Even though impressions of trustworthiness and likability of others are suggested to reflect an automatic ability to determine whether another person's intentions are good (Fiske et al., 2007), judgments of whether another person has dishonest intentions are often biased and wrong. This may be the case because the literature on deception detection has primarily focused on asking people to make a decision between a 'truth' or a 'lie' judgment. These so-called direct veracity judgments are often biased towards making a truth judgment (i.e., a "truth-bias"; Levine, Park, & McCornack, 1999). Moreover, judgments that explicitly ask people to say whether another person is lying are wrong about half of the time; meta-analyses show that people perform around chance level at detecting deception (Bond & DePaulo, 2006). A possible reason for this could be that when people make a judgment of whether someone else is lying, they expend too much cognitive effort. This deliberated judgment may be influenced by a truth-bias, and furthermore, it may overshadow correct intuitions.

In line with this, Albrechtsen, Meissner, and Susa (2009) found that when people make veracity judgments while they rely on their intuitions, they are indeed better to distinguish truth-tellers from liars. In one of their studies, participants made their judgment from either a short video fragment that lasted no more than 15 seconds or a long 3-minute video of another person. Judgments made on the basis of the short videos—presumed to make participants rely on intuitive forms of processing (Ambady, 2010; Ambady & Rosenthal, 1992)—were found to be more accurate. In another study that tested the beneficial effect of intuitive processing more directly, Albrechtsen et al. (2009) found that being under cognitive load also increased deception detection performance. These findings point toward the potential of effortlessly formed impressions of veracity.

There are several other indications in the literature that suggest that when veracity judgments are made in a less explicit or deliberated manner than with the direct judgment of whether someone is lying, these judgments are better able to distinguish truth-tellers from liars. Early indications of this were found in studies where participants were asked whether they thought the target was feigning

their reported affect (DePaulo, Jordan, Irvine, & Laser, 1982) or whether the target was thinking hard (Vrij, Edward, & Bull, 2001). Similarly, indirect questions that asked something about the observer (e.g., how confident they are of their judgment, how suspicious they felt, etc.) also seemed to be better able to differentiate between truths and lies (Anderson, DePaulo, & Ansfield, 2002; DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997). Additionally, subjective judgments of the demeanor of a target (e.g., are they blinking a lot?) were likewise found to better differentiate between truth-tellers and liars than objective counts of these same behaviors by independent coders (DePaulo et al., 2003). These findings, however, do not take in to account theoretical notions on which kind of judgments should be the least effortful.

It has been suggested that judging (moral) character and forming impressions of the intentions of others is an elementary, innate ability (e.g., Willis and Todorov, 2006; Fiske et al., 2007; Miller, 2007). Specifically, affective impressions of others are suggested to be especially automatic and effortless (Fiske et al., 2007; Zajonc, 1980). These judgments implicate the self in the sense that they concern the observer's affect ("I like this other person") instead of objective stimulus properties ("This other person is wearing a yellow shirt"). A second aim of this dissertation is to test these theoretical notions on effortless judgments in the realm of deception detection. Both judgments about the demeanor of a target (i.e., their ease of expression) as well as the observers' confidence in their judgments and their affective evaluations of the targets (i.e., whether participants like the target) are investigated. With these latter affective indirect judgments, I aimed to tap into people's effortless impressions of another person's honesty.

Furthermore, testing whether even from rehearsed statements these judgments still distinguish between truth-tellers and liars can assess the robustness of these effortless impressions. The impression that a rehearsed compared to a spontaneous story leaves on observers has received little empirical investigation thus far. However, next to the fact that, in daily life, statements and stories are often repeated, this characteristic of a story calls for an effort based approach. Rehearsing a story can influence effort in the deceiver, which in turn

influences the observer. To illustrate, rehearsing a story could relieve a liar from some of the cognitive burdens that are associated with lying. After all, the lie does not have to be made up anymore; it merely has to be repeated. This lie—now expressed with less effort—may then no longer be easily distinguished from a truth. Indeed, it can be expected that a target person has more ease of expression when retelling an untruthful story. Indirect judgments of honesty that ask an observer to judge the target's demeanor may therefore no longer differentiate a rehearsed liar from a truth-teller. Yet, if people indeed possess an ability to correctly detect deception on a more intuitive level, an effortless judgment that taps into this ability should distinguish lies from truths even if the targets' stories are rehearsed. Our understanding of deceptive interactions can therefore be advanced by examining the impact of whether a story is rehearsed on the accuracy of different indirect veracity judgments.

Reliance on effortless modes of processing

Just as effortless impressions of honesty may be tapped into with the kind of veracity judgment that is made, reliance on these effortless impressions can be increased under certain circumstances. Some situations call for more reliance on effortless modes of processing, meaning they push people to go with their intuition, or in other words, to 'listen to their gut'. It is likely that one of these situations is when people have to decide who is friend or foe in a novel and stressful environment. Under these circumstances it may be especially costly to affiliate with dishonest others. In order to direct affiliation and cooperation efforts towards individuals who have genuine intentions, one first has to be able to detect (dis)honest intentions in others. This ability may be enhanced if stressful situations indeed call for the kind of processing that is beneficial to the detection of deception.

Stress triggers neural responses that permit an adaptive and fast reaction to the situation. This is often referred to as a 'fight-or-flight' response (Cannon, 1914). Under stress, decision-making strategies that are controlled and take up more processing capacity are

thought to be hindered, while automatic responses are left relatively unaltered. Studies show that stress impairs prefrontal cortex (PFC) functioning (Qin, Hermans, van Marle, Luo, & Fernández, 2009) and decreases working memory performance (Schoofs, Preuss, & Wolf, 2008). Stress can thus lead to less deliberative processing (Starcke & Brand, 2012). Indeed, under stress people do not perform optimally on tasks that require effortful processing (Keinan, 1987; Starcke & Brand, 2012). For other tasks, however, less deliberative processing can be beneficial. This is the case, for instance, when forming impressions of others (Ambady, 2010). As mentioned above, people also seem to be able to detect deception especially well when their ability to deliberate is hampered (Albrechtsen et al., 2009). Stress may thus allow for a better ability to distinguish between liars and truth-tellers because it increases reliance on effortless modes of processing.

On top of this, it also seems that sensitivity to social cues is heightened during stressful negative experiences. For instance, people have been found to be better able to distinguish true smiles from fake ones after they were socially rejected (Bernstein, Young, Brown, Sacco, & Claypool, 2008). Research further suggests that in stressful situations people may automatically direct their attention toward relevant social information. For instance, stress has been found to increase neural activity and reaction times for emotional stimuli (Li, Weerda, Milde, Wolf, & Thiel, 2014). Liars who leak the feelings they are trying to mask, or who, for instance, feel guilt associated with lying, may be an easy target for an observer who is attuned to these emotions. In this dissertation I therefore examine whether evaluations of the trustworthiness of liars and truth-tellers may be enhanced under stress.

Effortless physiological responses to dishonesty

Physiological responses within the observer of dishonesty could provide additional insight into the effortless mechanisms of a deceptive interaction. Although research has investigated neural circuits underlying, for instance, judgments of the intentions of others (Grèzes, Frith, & Passingham, 2004) and the emotional processing

involved in making moral judgments (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), research on the psychophysiological mechanisms underlying deception has mainly focused on the physiology of deceivers (e.g., Podlesny and Raskin, 1977; Vrij, Oliveira, Hammond, & Ehrlichman, 2015; Wang et al., 2010). In order to come to a more comprehensive understanding of deceptive interactions, physiological reactions in the observer of deception should also be taken into account, especially because the observer's impressions are suggested to be affective and require little cognitive effort.

Assessing the psychophysiology of observers of (dis)honesty has several benefits. First of all, it allows for the measurement of people's responses while they observe dishonesty of others in an online fashion. Second, it serves as a way to measure unconscious reactions that are not yet overshadowed by explicit judgments. Physiological responses within the observer of dishonesty can therefore provide additional insight into the underlying mechanisms of a deceptive interaction. It has been suggested that physiological markers can precede explicit knowledge (Bechara et al., 1997), and that these markers influence decision-making (Bechara and Damasio, 2005, see Dunn et al., 2006, for a critical evaluation). In the case of deception detection, a physiological marker may precede explicit judgments of a liar.

A third aim of this dissertation is to explore the possibility of a physiological marker (i.e., an unconscious indicator) of deception detection while simultaneously replicating the aforementioned investigations regarding direct and affective indirect veracity judgments. Two different physiological responses within the observer of (dis)honesty are investigated. The first, finger skin temperature, reflects trust and unfolds slowly over time. The second, pupillary response, is a more fine-grained measure of mental processing. Building on classical (Bowlby, 1969; Harlow, 1958) as well as more recent work (IJzerman & Koole, 2011; Kang, Williams, Clark, Gray, & Bargh, 2011; Szymkow, Chandler, IJzerman, Parzuchowski, & Wojciszke, 2013) that relates temperature to trust and perceptions of trustworthiness, it is examined whether picking up on the deception of others reflects itself in skin temperature. Temperature can be seen as a

physiological proxy of social interactions, and as such it could be an important indicator of people's effortless impressions of (dis)honesty.

Temperature changes take a while to unfold over time, yet, often a lie consists of a brief answer to a question. In order to examine whether people unconsciously pick up on the dishonesty of others, the observers' physiological responses are therefore also examined with a more time-sensitive measure, namely the observers' pupillary response. Pupil dilation occurs together with, amongst other things, increased cognitive load (Beatty & Kahneman, 1966), emotional arousal for both positive and negative stimuli (Bradley, Miccoli, Escrig, & Lang, 2008), and changes in mental states that occur outside of awareness (Laeng, Sirois, & Gredeback, 2012). Further, pupillary responses can reveal processing of information that takes place even before there is conscious perception of this information (Chapman, Oka, Bradshaw, Jacobson, & Donaldson, 1999; Laeng, et al., 2012). Deception detection could therefore be reflected in differentially affected pupillary responses when observing an honest compared with a dishonest other. By exploring the above-mentioned physiological responses in the observer of (dis)honesty, I aim to shed light on effortless, unconscious reactions towards deception.

Overview of chapters and an additional note on honesty

In the following chapters I describe how I turned from manipulating the cognitive effort expended by possible liars, namely their working memory capacity (Chapter 2), to investigating how a manipulation of whether their stories were spontaneous or rehearsed influences the impression they give off (Chapter 3). I further describe how manipulating the observers' state—both in terms of vigilance and being forewarned—affects the ability to detect (dis)honesty (Chapters 4-5), and I end with my exploration of the inner state of the observer, namely with several investigations of physiological responses when observing (dis)honesty in others (Chapters 5-6). The chapters in this dissertation are based on individual papers that are either published or under review. Because they are all co-authored they are written in the 'we' form instead of 'I'. These chapters can be read separately or as a

set of examinations of the 'effortless' elements of a (dis)honest interaction: from the mind of the deceiver to the physiology of the deceived.

An additional note on honesty deserves a place in a dissertation on deception. As a social psychologist studying moral psychology, it is sometimes unavoidable to tempt participants to cheat in the lab. In the end I hope the knowledge that we gain from research on dishonesty will outweigh the costs by giving us a better understanding of how cheating can prevail in, for instance, the financial world, and why people are gullible enough to keep being duped by fraudsters. I have always tried to avoid having to deceive participants myself; when I promised them they would get paid for reporting something—whether they did so honestly or dishonestly—they got paid. When I told participants to prepare to give a public speech in front of psychologists, they actually gave this speech even though no relevant dependent variables were assessed after it. Furthermore, studying these topics made me ever more aware of the ease with which I myself, and other researchers like me, can fall prey to the biases and justifications that lead to, for instance, dishonest reporting of our outcomes. This led me to realize that the only way to prevent this is to call the shots ahead of time (see also, van 't Veer & Giner-Sorolla, 2015). Several of the studies reported in this dissertation are therefore pre-registered. Additionally, several studies that did not make it into the main chapters are presented in supplementary material that, like the data on which I base the main chapters, is available online.

Chapter 2. This chapter focuses on the question whether the decision to tell a lie is born out of an automatic tendency to do so or whether this unethical behavior is a result of deliberation. The argument is made that this question is best addressed from a cognitive effort point of view; by hindering participants' capacity to deliberate, the behavioral tendency that takes the least cognitive effort can be brought to light. A key finding of this chapter is that cognitive effort is a prerequisite for self-serving lies.

Chapter 3. This chapter focuses on the observer's ability to detect (dis)honest others. Next to examining anticipated veracity detection, this chapter was designed as a first test of the strength of affective judgments—as compared to other indirect veracity judgments—in discerning dishonesty. By presenting participants with targets who either tell a spontaneous story or who tell a rehearsed story, the question whether different types of indirect veracity judgments—if any—are enduring guides to detect (dis)honesty is addressed. This chapter demonstrates the merit of effortlessly formed affective veracity judgments.

Chapter 4. This chapter adds to the findings concerning effortless judgments from the previous chapter by examining whether being in a state of stress enhances dishonesty detection and trustworthiness detection from dynamic (video) material of liars and truth-tellers. Insights from evolutionary accounts about people's survival promoting abilities to judge the moral intentions of others are applied in a deception detection setting. It is suggested that the ability to detect (dis)honesty is enhanced under circumstances that call for effortless cognitive processing.

Chapter 5. This chapter explores both conscious direct evaluations of a target person's veracity as well as more effortless evaluative and physiological responses to observing (dis)honesty. Participants' finger skin temperature is studied in order to arrive at a more comprehensive understanding of deceptive interactions. This chapter is innovative in several respects. Next to investigating the physiology of the observer, this pre-registered research directly tests the magnitude of the effects of a direct and two related affective indirect veracity judgments against each other.

Chapter 6. This chapter describes an investigation of the pupillary responses of the observer of (dis)honesty. Participants' pupil dilation is measured while they observe a target person in a video who is asked about having cheated in a trivia game. Although all targets spontaneously deny having cheated, only half is telling the truth. The most important finding in this chapter is that pupil dilation is

differentially affected when observing a lie or a truth. Furthermore, results of the previous chapters pertaining to the merit of affective indirect veracity judgments are replicated in this chapter.

Chapter 7. This chapter contains a summary of the findings described in Chapters 2-6 and discusses these findings in terms of the cognitive effort lens that has been forwarded in this dissertation. Furthermore, in this chapter I discuss directions for future research and provide information on additional experiments that did not make it into the main chapters.

Chapter 2
Effortless honesty

In this chapter the boundary conditions of ethical decision-making are tested by hindering participants' ability to deliberate about the decision to be dishonest. As telling a lie is believed to be more cognitively taxing than telling the truth, we hypothesized that being under concurrent cognitive load would interfere with being dishonest. Participants anonymously rolled a die three times and reported their outcomes—of which only one outcome would be paid out—while either under high or low cognitive load. For the roll that determined pay, participants under low cognitive load, but not under high cognitive load, reported outcomes that were significantly different from a uniform (honest) distribution. The average reported outcome of this roll was also significantly higher in the low load condition than in the high load condition, indicating that participants in the low load condition lied to get higher pay. This pattern was not observed for the second and third roll where participants knew the rolls were not going to be paid out and where therefore lying would not serve self-interest. Results thus indicate that having limited cognitive capacity will unveil a tendency to be honest in a situation where having more cognitive capacity would have enabled one to serve self-interest by lying.

This chapter is based on: van 't Veer, A. E., Stel, M., & van Beest, I. (2014). Limited capacity to lie: Cognitive load interferes with being dishonest. *Judgment and Decision Making, 9,* issue 3, p. 199-206.

Chapter 2: Effortless honesty

Deception—intentionally misleading another person—is an omnipresent phenomenon that at times can greatly facilitate social interaction, but at other times can cause immense harm, pain, and have grave financial consequences. Telling a lie often comes with justifications and biases that permit people to lie (e.g., a self-serving bias) that likely happen out of conscious awareness. Yet, arguably, even these biases may take up some cognitive capacity. Here we test whether the decision to tell a lie is born out of people's intuitive, automatic tendency to do so or whether this unethical behavior is a result of more effortful cognitive processing. We do so by manipulating the availability of processing resources in an anonymous, tempting situation where dishonest behavior is typically observed. In other words, we test whether having a limited cognitive processing capacity makes people more honest than when they do have processing resources available.

Thus far, research on social decision-making has made use of a framework that divides the decision process into two systems (i.e., a dual-system framework; e.g., Evans, 2003; Haidt, 2001; Kahneman, 2011, but see Keren & Schul, 2009, for a critical evaluation). When making a decision, people are believed to rely both on automatic, sometimes called intuitive, processes, and more deliberative or controlled processes. In the case of moral decision-making, this dual-system framework has left researchers with evidence pointing in opposite directions. On the one hand, some have argued people have an intuitive sense to be prosocial and ethical. For instance, Rand, Greene, and Nowak (2012) find in several studies that people are intuitively cooperative. Some of these findings, however, have recently been questioned by Tinghög and colleagues (2013). The issues raised seem to center mainly around studies that use time pressure to bring about an automatic response, but not around other studies that use different manipulations, like inducing an intuitive mindset. Using methods to elicit intuitive decision-making, Zhong (2011) found intuition decreased the use of deception and increased altruism, strengthening to the notion the people are intuitively prosocial. On the other hand, others have argued that it takes

deliberation to decide to do the right thing; it was found that people's response under time-pressure was to be dishonest (Shalvi, Eldar, & Bereby-Meyer, 2012) and that contemplation leads to more ethical decisions (Gunia, Wang, Huang, Wang, & Murnighan, 2012). Findings from studies investigating moral behavior—and especially those investigating deception—thus paint an inconsistent picture.

A broad range of findings suggests that deception is cognitively taxing. First, evidence from evolutionary (Byrne & Corp, 2004) and developmental (Hala & Russell, 2001) research suggests deception involves complex cognitive processes. Second, relative to truthful responding, lying shows an increase in response time (Farrow et al., 2003; Spence et al., 2001) and an increase in cognitive effort as measured by pupil dilation (Wang, Spezio, & Camerer, 2010). Neuroimaging studies typically find lies elicit more activation in the brain than truths (Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003; Langleben et al., 2002; Lee et al., 2009), and consider the truth the "baseline" (Spence et al., 2004). Third, in the lie-detection literature, telling a lie is assumed to be more cognitively taxing: One has to make up a story, tell it coherently, monitor one's own and the other person's demeanor, and, arguably, regulate one's feelings about being unethical at the same time (Vrij et al., 2008; Zuckerman, DePaulo, & Rosenthal, 1981). Fourth, a process of justifying dishonest behavior is likely to take place when there is ample opportunity to do so (Shalvi, Dana, Handgraaf, & De Dreu, 2011), assumingly in order to maintain a positive self-image (Mazar, Amir, & Ariely, 2008). Even this kind of self-serving tendency, however widespread or unconscious, seems to take up some form of cognitive processing. Given the evidence outlined above, we argue that lying is cognitively taxing, and that it thus should not be observed when cognitive capacity is unavailable.

However, a study in which participants had the opportunity to lie to serve their self-interest indicated that participants were more dishonest with time-pressure than without it (Shalvi et al., 2012). Authors of this study interpreted this finding by suggesting that dishonesty is people's automatic tendency when self-interest can be served. In reply, however, Foerster, Pfister, Schmidts, Dignath, and Kunde (2013) noted that this finding might be due to specifics in the

procedure, namely that participants could have decided on their response while apprehending the task. Foerster et al. did not impose time-pressure but manipulated response time by asking their participants to report an outcome of a die roll immediately, or after a short delay. Their findings suggest that immediate responses are more honest than delayed responses, and that these differences disappear when participants are more familiar with the task due to doing it a second time. It could thus be the case that the relationship between response time and honesty is not linear, but that honesty depends on other factors like the level of cognitive processing capacity that is available. We argue here that manipulating cognitive load is better suited to further this debate. Because imposing cognitive load can effectively reduce the available processing capacity, it can distinguish between responses that draw on more or less processing resources.

As previous experiments have demonstrated, individuals under cognitive load have a more pronounced tendency to respond in accordance with their automatic, affective intuition. For instance, it leads people to choose chocolate cake over fruit (Shiv & Fedorikhin, 1999). In the moral judgment literature, cognitive load has been found to make people less likely to make an utilitarian judgment (Trémolière, De Neys, & Bonnefon, 2012) and respond slower for this kind of controlled cognitive judgment (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008). Valdesolo and DeSteno (2008) saw the self-serving bias that is typically observed in the hypocrisy literature disappear when imposing their subjects to high cognitive load; these subjects judged a moral transgression performed by themselves as unfair as when it was performed by another individual, indicating they had no cognitive capacity to make self-serving justifications under cognitive constraint. Similarly, although lying might be a quick response, it could still require some additional cognitive resources. On the basis of this, and on the basis of the four previously mentioned arguments, we predict dishonesty to be reduced under cognitive load.

To measure deceptive behavior we employ the “Die under the cup” paradigm that has been used in similar research settings (Fischbacher & Heusi, 2008; Shalvi et al., 2011). In this paradigm, participants anonymously report the outcome of their die roll for money—where a higher outcome equals higher pay—giving them an

incentive to lie. This paradigm does not allow assessment of individual dishonesty, yet the distribution of reported outcomes can be compared to a distribution expected by chance, which would indicate no dishonesty. Conversely, if more high numbers are reported than can be expected by chance, this result indicates dishonesty. For our purposes, a setting wherein participants report their first die roll for payment and roll the die a second and third time for no payment is especially appropriate. Under these circumstances—where desired numbers might be observed on the second and third roll—it is found that people are especially inclined to lie because the lie is justified more easily (Shalvi et al., 2011). To minimize the possibility that participants decide what to report before they even roll the die, we amended this paradigm such that the participants learned which of their three rolls would be paid out only just before reporting them.

In the current experiment, participants thus have the opportunity to serve self-interest by being dishonest in an anonymous setting. During this opportunity, we ask them to perform a concurrent task that imposes either high or low cognitive load. We argue that under high cognitive load the main executive function with which the working memory will be engaged is the concurrent task, thereby leaving less room to process or manipulate information needed to tell a lie (i.e., the ramifications or the fabrication and justification of the lie, respectively) while at the same time leaving less room for the monitoring and regulation required to do so (i.e., the assimilation of emotions or withholding of factual information, respectively). We therefore expect less dishonesty when under higher cognitive load. Additionally, for those who do have enough cognitive capacity to lie, we expect dishonesty to occur only when self-interest can be served, namely when lying is associated with monetary gain.

Method

Participants and design

A total of 173 participants (117 females, M_{age} = 21.26, SD = 2.61) took part in this experiment. Participants were randomly

assigned to either a high cognitive load or a low cognitive load condition. Participants were paid the outcome of their first reported die roll in Euros and received additional money for their performance in other experiments later in the same experimental hour. Sample size was a result of terminating data collection after one week (as was decided beforehand). We report all data exclusions (if any), all manipulations, and all measures in the study.

Materials and procedure

An experimenter showed the participants how to roll a die underneath a cup by shaking the cup back and forth, then told them all to practice rolling the die this way at least three times. Participants were asked to look through a hole in the bottom of the cup each time they rolled the die to see their outcome. They then proceeded individually, using a computer on their desks separated by partition screens, while the experimenter remained outside of the view of the participant in the far front of the room. Participants read that the study was about multitasking and memory, and that they would be asked to memorize a string of letters while rolling a six-sided die three times. An example of a string was given with the same number of letters participants would encounter later in the experiment. Participants were told one of the three rolls—to be randomly assigned by the computer at a later time—would be paid out and that their pay was conditional on their performance on the memory task. Participants in the high cognitive load condition memorized a string of eight letters[2] (i.e., NWRBRKPJ), and participants in the low cognitive load condition memorized a string of two letters (i.e., KL). In both conditions participants were given ten seconds to memorize their letter string. They were then instructed to roll the die three times (the screen auto-advanced after 30 seconds), and subsequently they were asked to report all three outcomes. After this, they were asked to reproduce their letter string. Importantly, just before reporting the outcome of the first roll—but after having rolled the die three times—all participants

[2] Letters were chosen instead of numbers (see for the manipulation with numbers Gilbert & Hixon, 1991) to prevent interference with the numbers seen on the die.

were told the computer had decided their first roll would be paid out.

Participants then completed three manipulation check questions. First, to ensure that participants in the high load condition were in fact occupied with the letter string, we asked them to indicate how much they agreed with the following statement: *While rolling the die, I was mainly thinking of the string I had to remember* (scale from 1 = *totally disagree* to 5 = *totally agree*). To ensure that any observed differences between the two load conditions would not be due to participants in the high load condition having trouble perceiving the outcome of all three rolls, we asked them whether they agreed with: *I took a good look at all three rolls* (scale from 1 = *totally disagree* to 5 = *totally agree*). To make sure any differences observed between conditions would not be due to participants having trouble remembering their outcomes, we asked participants to indicate: *How many of the rolls did you remember seeing?* (0 = *none*, 1 = *one*, 2 = *two*, 3 = *all three rolls*). Next, participants answered one question pertaining their feelings of entitlement to full payment: *I feel I have the right to earn six Euros* (slider from 0 = *totally disagree* to 100 = *totally agree*). This question enabled us to ensure that observed differences were not due to varying feelings of entitlement to payment.

For exploratory reasons, participants were then presented with emotion items. We assessed emotions because being dishonest might cause people to feel negative emotions, especially when they have no means of justifying their behavior (Shalvi et al., 2012), or positive emotions, caused by the thrill of cheating (Ruedy, Moore, Gino, & Schweitzer, 2013)[3]. Participants were then probed for suspicion, yet

[3] Four positive items (e.g., "happy", "content"; α = .87), and sixteen negative items (e.g. "sad", "tense"; α = .93; all scales ranging from 0 = *not at all*, 7 = *very much*) were randomly presented, and one overall mood scale (slider from -50 = "*very bad*"; 50 = "*very good*"). Due to technical failure, five participants' answers to the mood questions were not recorded (3 in low load, 2 in high load). Independent-samples t-tests were conducted to compare the mean of the positive emotion items between conditions and the mean of the negative emotion items between conditions. Participants in the low load condition felt more positive emotions (M = 4.94, SD = 1.00) than the participants in the high load condition (M = 4.40, SD = 1.24), $t(166) = 3.10$, p

none was aware of the aim of the study, and demographics were ascertained.

Results

Manipulation check

We performed separate independent-samples t-tests with condition as the independent variable and the manipulation check questions as dependent variables. These analyses indicated that participants in the high load condition were thinking of their string of letters more (M = 3.97, SD = 1.60) than participants in the low load condition (M = 2.79, SD = 1.50), $t(171) = -4.97$, $p < .001$.[4] There was no difference in how good a look participants had at their three rolls between the high load (M = 4.68, SD = 0.69) and the low load condition (M = 4.79, SD = 0.49), $t(154.86) = 1.24$, $p = .22$. Almost all participants in both the high load condition (M = 2.95, SD = 0.21) and the low load condition (M = 2.98, SD = 0.22) remembered seeing all three rolls. This memory did not differ between the conditions, $t(171) = 0.70$, $p = .48$. Participants in the high load condition did not feel significantly more entitled to full pay (M = 73.22, SD = 29.28) than

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< .01. For the negative emotions, there was a marginally significant difference between the low load condition (M = 1.93, SD = .83) and the high load condition (M = 2.21, SD = 1.12), $t(166) = -1.84$, $p = .07$. However, there was no difference between overall mood between the low load condition (M = 26.13, SD = 12.98) and the high load condition (M = 22.02, SD = 18.34), $t(166) = 1.67$, $p = .10$. None of the three mood scales correlated with the reported die rolls in the two conditions, all p's > .23.

[4] Although all participants in the low load condition remembered their letter string correctly, only 58.6 % of participants in the high load condition were able to remember their eight letters correctly and in the right order, indicating this task was indeed cognitively taxing. 37.9 % got 6 or more letters correct, but the letters were not in correct order. 3.4 % got 5 or less letters correct. Distributions of the three reported outcomes of these participants that did not get the letter string correct in the high load condition were not significantly different from uniform, all ps > .38, meaning their results did not deviate from our main findings.

participants in the low load condition (M = 70.16, SD = 29.05), $t(171) = -0.69$, $p = .49$. These results indicate that our manipulations worked as intended. Additionally, the time participants took to submit the page on which they reported the outcome of their first die roll did not differ between the low load condition (M = 7.41, SD = 3.81) and the high load condition (M = 7.23, SD = 4.31), $t(171) = 0.28$, $p = .78$.

Table 2.1. *Frequency and corresponding percentage (in parentheses) of the reported outcomes of all three die rolls for both conditions*

		Reported outcome of die roll					
		1	2	3	4	5	6
Roll one	Low load	6 (6.98)	6 (6.98)	10 (11.63)	26 (30.23)	15 (17.44)	23 (26.74)
	High load	13 (14.94)	10 (11.49)	13 (14.94)	22 (25.29)	20 (22.99)	9 (10.34)
Roll two	Low load	13 (15.12)	12 (13.95)	15 (17.44)	17 (19.77)	16 (18.60)	13 (15.12)
	High load	9 (10.34)	14 (16.09)	12 (13.79)	24 (27.59)	11 (12.64)	17 (19.54)
Roll three	Low load	9 (10.47)	15 (17.44)	10 (11.63)	13 (15.12)	19 (22.09)	20 (23.26)
	High load	16 (18.39)	16 (18.39)	7 (8.05)	11 (12.64)	21 (24.14)	16 (18.39)

Note. Full dataset is available at: https://opensciencefframework.org/project/zhejr/node/25txz/

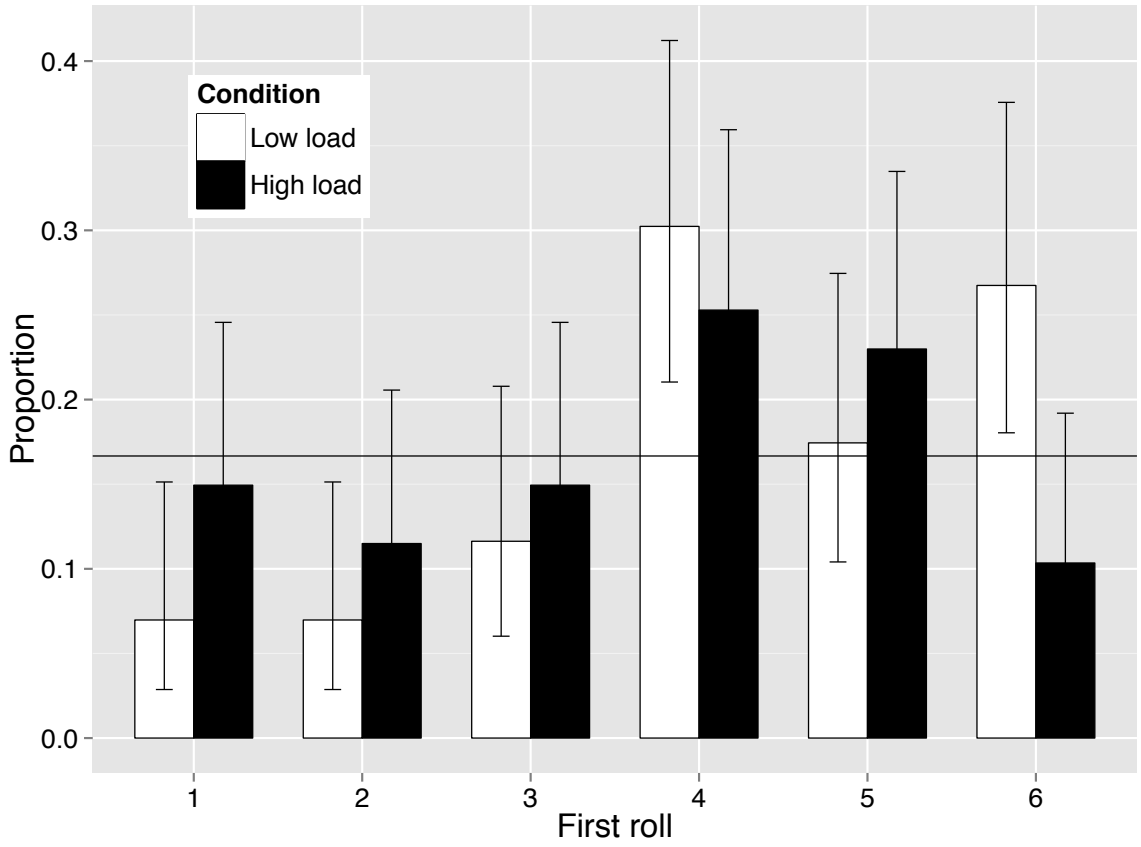

Figure 2.1. Bars represent the proportion of participants who reported having outcome one through six on the roll that determined pay, for low and high cognitive load conditions. The horizontal line represents the proportion of each of the outcomes of a fair die roll according to chance (.16667 for each outcome). Error bars represent 95% confidence interval of the proportion.

Distribution of reported outcomes

Table 2.1 shows the frequencies of reported outcomes for each possible outcome of a six-sided die. We tested whether the reported outcomes in both conditions differed from a uniform distribution with a chi-square test in order to examine whether the reported rolls resemble a distribution that can be expected by chance (i.e., a fair distribution). In the high load condition, the distribution of the first die roll—the roll that was going to be paid out—was almost significantly different from a uniform distribution, due to a tendency for the number 4 to be over reported, $\chi^2(5, N = 87) = 9.76$, $p = .08$. The second roll did not differ significantly from a uniform distribution

either, $\chi^2(5, N = 87) = 10.03$, $p = .07$ (if anything, this small effect was also caused by four being the most reported roll, see Table 2.1), nor did the third roll, $\chi^2(5, N = 87) = 8.10$, $p = .15$. In the low load condition, however, the reported outcomes for the first die roll did differ from a uniform distribution, $\chi^2(5, N = 86) = 25.77$, $p < .001$, indicating dishonest reporting of the to be paid out roll (see Figure 2.1). The second and third rolls did not differ significantly from a uniform distribution in the low load condition, $\chi^2(5, N = 86) = 1.35$, $p = .93$ and $\chi^2(5, N = 86) = 7.21$, $p = .21$ respectively.

Importantly, the average reported outcome of the first roll of the die was higher in the low load condition ($M = 4.24$, $SD = 1.49$) than the high load condition ($M = 3.60$, $SD = 1.57$), Mann-Whitney $Z = -2.61$, $p = .009$, indicating that participants in the low load condition lied to get a higher pay. As hypothesized, for the second roll, the outcome in the low load ($M = 3.58$, $SD = 1.66$) and the high load ($M = 3.75$, $SD = 1.61$), did not differ, Mann-Whitney $Z = -0.63$, $p = .53$. Similarly, the outcome of the third roll did not differ between the low load ($M = 3.91$, $SD = 1.71$) and the high load ($M = 3.61$, $SD = 1.81$), Mann-Whitney $Z = -1.01$, $p = .27$.

Discussion

In the current chapter we tested whether having limited cognitive capacity impairs people's ability to lie. We found a considerable amount of dishonesty when cognitive capacity was not limited, but no detectable dishonesty when cognitive capacity was limited. This pattern of deception—lying when cognitive processing was possible and being honest when it was not—was observed only for the outcome of the die roll that had financial consequences. This suggests that when enough cognitive capacity is available *and* people can serve self-interest by being dishonest, they will often do so. Yet without this cognitive capacity, people are honest regardless of the fact that self-interest could have been served.

In anonymous situations, not unlike the one we created in the current experiment, cognitive control might be needed to override self-serving biases. We argue, however, that a certain amount of

cognitive processing might also already be in place to shape the bias itself. Comparing our results with findings by Valdesolo and Desteno (2008), it could be argued that, in both studies, imposing cognitive load led to a diminished capacity to serve the self. In other words, although people have an automatic tendency to be self-serving, this automatic reaction requires some mental processing still. A parallel can be drawn with research on stereotyping, where cognitive load is found to make the activation of a stereotype less likely to occur; yet when the stereotype is already activated, cognitive load increases its usage (Gilbert & Hixon, 1991). This suggests that although the activation of a stereotype is fairly automatic, to be able to activate the information some cognitive resources are still required.

Our findings are in line with several other lines of research that invoke a dual-process framework. For instance, activating an intuitive mindset, in contrast to deliberative mindset, can lead people to deceive less (Zhong, 2011). Likewise, in a recent paper, it was argued that people are intuitively cooperative, for those who decide quickly (either by instruction or on their own) and those who are induced to rely on their intuition, contribute and cooperate more in economic games (Rand, Greene, & Nowak, 2012, but see Tinghög et al., 2013, for a different perspective on the time pressure data). Next to this, people who have a generally preferred thinking style of relying on their intuition may be more inclined to show sharing behavior and altruistic punishment (Kinunnen & Windmann, 2013). Another corresponding notion is that working memory is indirectly related to dishonesty through the ability to be creative in finding justifications for this dishonesty; working memory relates positively to creative performance (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012) and creative people have been found to cheat more (Gino & Ariely, 2012).

Contrary to our findings however, a recent experiment utilizing a variation of the paradigm used in the current chapter observed more dishonesty under time pressure (Shalvi et al., 2012). This contradiction is surprising, because time pressure and cognitive load have often been used interchangeably, namely to lay bare an automatic process. One possible reason for these deviating findings could be that our procedure was adjusted such that participants' opportunity to justify any lies beforehand was kept to a minimum.

Namely, only after rolling the die three times were participants in the current study informed about which of their die rolls would earn them money. In the procedure utilized by Shalvi and colleagues (2012) participants knew that the one roll they were going to report was for money even before being under time pressure. Similar to the argument made by Shalvi and colleagues (2012), others have found that being forced to contemplate for 3 minutes about the decision to lie decreased deception, as compared to an immediate choice that had to be made within 30 seconds (Gunia et al., 2012). What remains unclear however, is whether in these cases the immediacy with which the decision had to be made was pressing enough to stop any justification or rationalization, which arguably could have already taken place while apprehending the nature of the task.

Another difference between our cognitive load manipulation and the aforementioned time pressure manipulation is that our participants had two concurrent demands on cognitive capacity instead of having one task demanding immediate capacity. This difference could have led participants under time pressure—contrary to those under cognitive load—to have just enough cognitive capacity to generate an untruthful response. In that case, even though time pressure will make observing the product of automatic processing more likely because further processing (i.e., deliberation) is not possible, some processes like self-serving biases or relying on heuristics might still occur under time pressure. These processes may happen extraordinary fast and mostly outside of conscious awareness and can therefore arguably be considered part of the automatic response. As Balcetis and Dunning (2006) showed, people readily see what they are motivated to see. People may be unaware of self-serving biases because these biases operate outside of conscious awareness. The possibility that under time-pressure self-serving biases are present but under cognitive load they are not is currently insufficiently founded. It does, however, open up an opportunity for further research to explore what processes make up the automatic part of the dual system. As has been argued before, both systems involve cognition in the sense of information processing (Cushman, 2013). The question, then, is not what the automatic tendency is during (dis-)honesty junctures, as both lying and being honest can be automatic, but what

processes contribute to the automaticity of the given tendencies.

Although a body of research presumes lying is a deliberate act, an indication that a process takes up cognitive capacity—such as found here—does not necessarily entail that this process is not also somewhat automatic. The process of reporting the truth might just be one that is relatively less prone to interference by simultaneous demand on cognitive capacity than the self-serving bias that so often comes on top of it. The current chapter therefore calls for further empirical clarification on the different effects of manipulations such as time pressure and cognitive load, and also on their differences with, for example, depletion of self-control resources. This manipulation is known to increase cheating (e.g., Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009), a result possibly due to not having enough executive resources to identify an act as moral or immoral (Gino, Schweitzer, Mead, & Ariely, 2011). However, studies that did not focus on cheating but instead focused on lying found lying was not affected by depletion (Debey, Verschuere, & Crombez, 2012). In light of the abovementioned findings, it thus seems that although serving self-interest is usually fairly easy, lying is not.

Conclusion

To understand unethical behavior, we need to study the prerequisites for such dishonest behavior to take place. Findings of the current chapter suggest that one of those prerequisites is having ample cognitive capacity. On the societal level, a moral basis that pulls people's behavior away from pure self-interest is indispensible. Although individuals are often found to act in their own interest, and lying is often done out of self-interest, solely on the basis of this it would be unwise to conclude that being deceptive is the default: The current chapter shows that telling the truth is the most effortless option in terms of cognitive processing and that telling a lie takes at least some additional mental effort.

Chapter 3

Effortless impressions of honesty

It is advantageous to correctly assess the honesty of stories others tell. In this chapter we argue that it is important to consider whether these stories are spontaneous or rehearsed and whether veracity judgments are assessed directly or indirectly. We examined both anticipated veracity detection (Study 3.1, N = 236) and actual veracity detection (Study 3.2, N = 147). Results revealed that participants anticipated being better at distinguishing spontaneous truths and lies than at distinguishing repeated truths and lies. This resonated with actual detection ability when it was measured by direct veracity judgments: Whereas during initial statements liars came across more deceptive than truth-tellers, during repeated statements this distinction disappeared. Affective indirect judgments, however, distinguished between truth-tellers and liars irrespective of whether statements were repeated. This suggests that while direct veracity judgments no longer discriminate between liars and truth-tellers when accounts are repeated, inherently more affective indirect judgments remain valuable guides to (dis)honesty.

This chapter is based on: van ’t Veer, A. E., Stel, M., & van Beest, I. (2015). *Detecting deception from repeated statements: Indirect affective judgments as guides to dishonesty.* Manuscript submitted for publication.

Chapter 3: Effortless impressions of honesty

People are passionate narrators. Regardless of whether their stories are true or untrue, people who tell the truth and people who lie have the same goal: To come across as an honest person. When people want to be believed, a common solution and often given advice is to rehearse a statement. Indeed, in many domains it has been argued that practice makes perfect (e.g., Ericsson, Krampe, & Tesch-Römer, 1993). Similarly, irrespective of whether the aim is to convince another person with the truth or with a lie, one could argue that practice benefits the way a story comes across. However, as we argue here, telling a story repeatedly may have its pitfalls, especially for truth-tellers. When truth-tellers' repeated stories are assessed in a direct way (i.e., with the question whether the story is true or false), repeated truths may be mistaken for lies.

Affective character assessments of the story teller, in contrast, may prove a more robust guide to trustworthiness if, in the case of deception detection, they serve their suggested role of picking up on the moral intentions of others (e.g., Fiske, Cuddy, & Glick, 2007). If this is indeed the case it can be expected that—irrespective of whether an account is given repeatedly—observers' affective judgments of truth-tellers remain more positive than their judgments of liars. In the current chapter we investigate this by examining whether statements—both true and false—appear less deceptive when they are told for the second time compared to the first, and whether their narrators leave a different impression when giving these two accounts of the same story. This impression is assessed with different indirect veracity judgments, including the above-mentioned affective judgment (i.e., how much the observer likes the story teller). In doing so, we challenge the notion that a practiced story is always a convincing one.

Distinguishing truths from lies

Telling lies is commonplace. Therefore, being on the receiving end of deception is, inevitably, common as well. Despite

this, people barely perform above chance when trying to detect deception (Bond & DePaulo, 2006). Although the quest for what differentiates a liar from a truth-teller has been present in the literature for a long time, cues to deception appear to be weak, if not lacking in existence (e.g., DePaulo et al., 2003). What seems to be left is the impression a liar makes on the target of her deception: Liars' stories come across more tense and less forthcoming (DePaulo et al., 2003). Additionally, observers' affective and indirect judgments of liars do seem to discriminate between liars and truth-tellers. For instance, the same targets are liked and trusted less when they lie compared to when they tell the truth. However, when people are asked to judge these same targets' veracity *directly*, the ability to correctly detect a liar is around chance level (e.g., van 't Veer, Stel, van Beest, & Gallucci, 2014). This speaks to the idea that it is useful to distinguish direct and indirect veracity judgments.

The amount of cognitive load associated with telling a lie could also play an important role when it comes to differentiating liars from truth-tellers (Vrij, Fisher, Mann, & Leal, 2008). The lie itself has to be thought up, whereas the truth is something that merely has to be recalled. The assumption that lying requires more cognitive capacity than being honest is supported by research showing individuals lie less when their working memory is taxed (van 't Veer, Stel, & van Beest, 2014). In similar vein, spontaneous lies compared to truths are found to be more cognitively demanding as measured by saccadic eye movement rate (Vrij, Oliveira, Hammond, & Ehrlichman, 2015)—a measure that indicates searching long-term memory (Ehrlichman & Micic, 2012). Liars might also be more aware of themselves and their performance, leading to a higher level of monitoring and controlling verbal and nonverbal behavior (DePaulo, Kirkendol, Tang, & O'Brien, 1988; Zuckerman, DePaulo, & Rosenthal, 1981). As a consequence, liars may leave an impression of having to think hard. This impression raises suspicion in the perceiver and has been found to distinguish truth-tellers from liars (Ulatowska, 2010, 2014; Vrij, Edward, & Bull, 2001).

Observers' impression of repeated stories

The cognitive load that liars experience may thus make them easier to detect. This raises the question of whether rehearsing or repeating a lie could relieve some of these cognitive burdens. In a study by DePaulo, Lanier, and Davis (1983) it was found that answers to known (vs. unknown) questions came across more deceptive, more tense, and less spontaneous. This occurred regardless of whether these planned answers were true or false. Notably, the planned lies were not more or less readily detectable. However, merely planning an answer may not decrease the necessary effort as much as actual rehearsing. For instance, reaction times when lying become faster after training, more so than after debriefing and instruction to speed up (Hu, Chen, & Fu, 2012). Moreover, lies that are rehearsed and memorized appear to be associated with less cognitive conflict compared to spontaneous lies, as evidenced by decreased activities in brain regions involved in cognitive control, such as the anterior cingulate cortex (ACC; Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003). Additionally, response times of practiced lies decrease and thereby closer resemble the response time of truths (Walczyk, Mahoney, Doverspike, & Griffith-Ross, 2009). However, it remains unclear whether rehearsing a lie does indeed leave a more positive impression on observers. We propose that a repeated lie may become more polished. This makes the liar appear to have more ease of expression, which in turn could impair the actual detection of deception. Indeed, as considered by DePaulo et al. (2003), the idea that lying is more difficult than telling the truth may only apply when liars are making up new stories, instead of referring to stories from others or replacing one event with another. It seems then, that when a liar is repeating a lie told earlier, the hard part is over, as the story is already made up. This, in turn, would suggest that detecting deception becomes more difficult for a repeated lie than for an initial lie.

And what about truth-tellers? Do they benefit from repeating their story just like liars might? One could argue that repeating an account could also be beneficial for truth-tellers. After all, a rehearsed truth may become more polished and therefore leave a more positive impression. However, prior research indicates that truth-tellers' stories

are often full of mistakes and self-corrections, and this is true even though an account is given multiple times. Specifically, Granhag and Strömwall (2002) found that liars and truth-tellers have equally consistent statements during the course of multiple interrogations. Liars' statements are stable because liars adapt their strategy to remember their statements. Truth-tellers' statements are also stable, but often undermined by the likely weaknesses associated with normal memory performance. Because for truth-tellers a story that was told initially may not have been intended for future use, recalling the account as it was told the first time may require additional cognitive effort in instances where the aim is to keep consistent. Recalling information stored in memory is cognitively taxing, and as cognitive resources are limited, having a concurrent task that requires cognitive capacity leaves fewer resources available for recall (van den Hout et al., 2010). A retold truth may therefore seem more deliberated upon. Another possibility is that truth-tellers may be less preoccupied with coming across honest; after all, they have the truth on their side. For truth-tellers, it thus seems unclear whether the retold story comes across with more or less ease of expression, whether it feels deceptive to the observer, and whether the truth-tellers' innocence still reflects a moral character that can be differentiated from that of a liar when the truth is retold.

Taken together, it seems that observers' subjective, indirect impressions of liars can differentiate liars from truth-tellers, but it is unclear whether this is still the case when a story is retold. Repeating a lie could relieve the liar of some of the cognitive load associated with, for instance, coming up with the lie itself. As a consequence, compared to a first-time lie, a repeated lie could be more difficult to detect due to the liar coming across, for instance, more confident and less nervous. For truth-tellers, the prediction is less clear. On the one hand, a truthful story may benefit from repetition. On the other hand, it might even be impaired by it. If it is the case that retelling a truthful story impairs the truth-teller's impression, an honest person could be mistaken for a liar.

In addition, it may be argued that repeated stories, both true and false, may bare such a resemblance that both direct and indirect assessments will fail to differentiate a truth-teller from a liar.

However, it has been previously argued that on an intuitive level, people may have a better sense of whether another person is lying to them (Albrechtsen, Meissner, & Susa, 2009). Provided that affective judgments tap into a 'gut feeling' that can intuit whether someone is lying, it may also be expected that this intuition will hold even for instances where truths and lies are being repeated. If this is the case, than both direct and indirect judgments will differentiate liars from truth-tellers when their stories are told for the first time, whereas only affective indirect veracity judgments will be able to differentiate liars from truth-tellers when stories are repeated.

Building on the premise that people place high value on narratives and accounts of events told by others, and that accounts are often given on multiple occasions, we tested two facets of retelling true and untrue stories. In Study 3.1, we investigated people's intuitions pertaining to what the best chance of coming across honest would be: an initial or a repeated account of the same event. In Study 3.2, we subsequently tested our main expectation, namely that people's actual ability to differentiate truths from lies is better for initial accounts than for repeated accounts. Furthermore, we test different indirect judgments pertaining both to how a target person comes across and to the observers' own feelings towards the target person, in order to assess whether these indirect measures endure as appropriate guides to veracity even for repeated accounts.

Study 3.1

In Study 3.1 we investigated three aspects of how people anticipate themselves and others to react to initial and repeated accounts of a story. First, we assessed whether people anticipate repeated accounts to come across better than initial accounts. Specifically, we asked participants to indicate to what extent they thought listening to an initial or a repeated account would make them feel lied to, a judgment we refer to as the anticipated direct veracity judgment. Second, we also asked them to choose which account, initial or repeated, would come across more deceptively. Third, we asked participants whether they would rehearse a story or tell a story

right away. We asked separate groups of participants to indicate this for either truthful or deceitful stories. Assuming that people have more feedback and experience with whether their own deception is detected and whether it is retold than with whether others are dishonest and whether their account is retold, we explored the effect of perspective and asked separate groups of participants to take the perspective of the listener or the perspective of the teller of the story.

Method

Participants and design. Two hundred and thirty six psychology students—166 females, 47 males, 23 unknown, M_{age} = 19.93, SD_{age} = 5.86 (age of 24 unknown)—took part in this study. Sample size was determined by the number of first year students that participated in the yearly testweek of the psychology department at Tilburg University. This resulted in a big enough sample size to have over 80% power to find a small effect. Participants were randomly assigned to one condition of a 2 (perspective: self or other) × 2 (veracity: truth or lie) between-subjects design (each n = 59). We report all data exclusions (there were none), all manipulations, and all measures in the study.

Procedure. Veracity was manipulated by instructing participants to either imagine that an untruthful or a truthful account was going to be given about activities on the previous day. Perspective was manipulated by instructing participants to imagine that they would tell the account to another person or that they were listening to another person who gave the account. Next, we assessed the anticipated direct veracity judgment with two separate questions. Participants were asked to indicate to what extent the person who was listening to the account (which, depending on condition, was the participant him/herself or another person) would feel lied to (a) when the account was given initially and (b) when the account was given repeatedly (both scales ranging from 1 = *not at all* to 7 = *very much*). These two questions thus constitute a repeated measure of anticipated feelings of being deceived, namely during both the initial and the repeated account. This was followed by a forced choice on which participants had to indicate whether the initial or the repeated account would come across more deceptive. Lastly, another forced choice

followed between what they or the other person (depending on perspective) would do: 1) rehearse the same story on a different person first, or 2) tell it right away without rehearsing.

Results

Anticipated direct veracity judgment. A 2 (perspective: self vs. other) × 2 (veracity: truth vs. lie) × 2 (account: initial or repeated) mixed design ANOVA on the anticipated feelings of being deceived resulted in a main effect of perspective, $F(1, 232) = 23.60$, $p < .0001$, $\eta_p^2 = .09$, a main effect of veracity, $F(1, 232) = 23.60$, $p < .0001$, $\eta_p^2 = .09$, a main effect of account, $F(1, 232) = 11.56$, $p < .001$, $\eta_p^2 = .05$, no interaction between perspective and veracity, $F(1, 232) = 1.43$, $p = .23$, $\eta_p^2 = .01$, an interaction of perspective and account, $F(1, 232) = 14.60$, $p < .0001$, $\eta_p^2 = .06$, and an interaction of veracity and account, $F(1, 232) = 4.28$, $p = .04$, $\eta_p^2 = .02$. The three-way interaction did not reach significance, $F(1, 232) = 1.68$, $p = .20$, $\eta_p^2 = .01$.

The perspective × account interaction (see Figure 3.1) showed that whereas participants anticipated their own first accounts not to come across more deceptive ($M = 3.08$, $SE = .14$) than their repeated accounts ($M = 3.03$, $SE = .13$), $F(1, 232) = .09$, $p = .766$, $\eta_p^2 < .001$, 95% CI [-.29, .39], for others' accounts participants anticipated the repeated account to come across more deceptive ($M = 4.23$, $SE = .13$) than the first ($M = 3.36$, $SE = .14$), $F(1,232) = 26.07$, $p < .0001$, $\eta_p^2 = .10$, 95% CI [.54, 1.12]. Initial accounts were not anticipated to come across differently when told by another person than when told by the participants themselves, $F(1, 232) = 1.92$, $p = .167$, $\eta_p^2 < .01$, 95% CI [-.12, .68]. Repeated accounts were anticipated to come across more deceptively when told by another person compared to when told by participants themselves, $F(1, 232) = 41.26$, $p < .0001$, $\eta_p^2 = .15$, 95% CI [.83, 1.57].

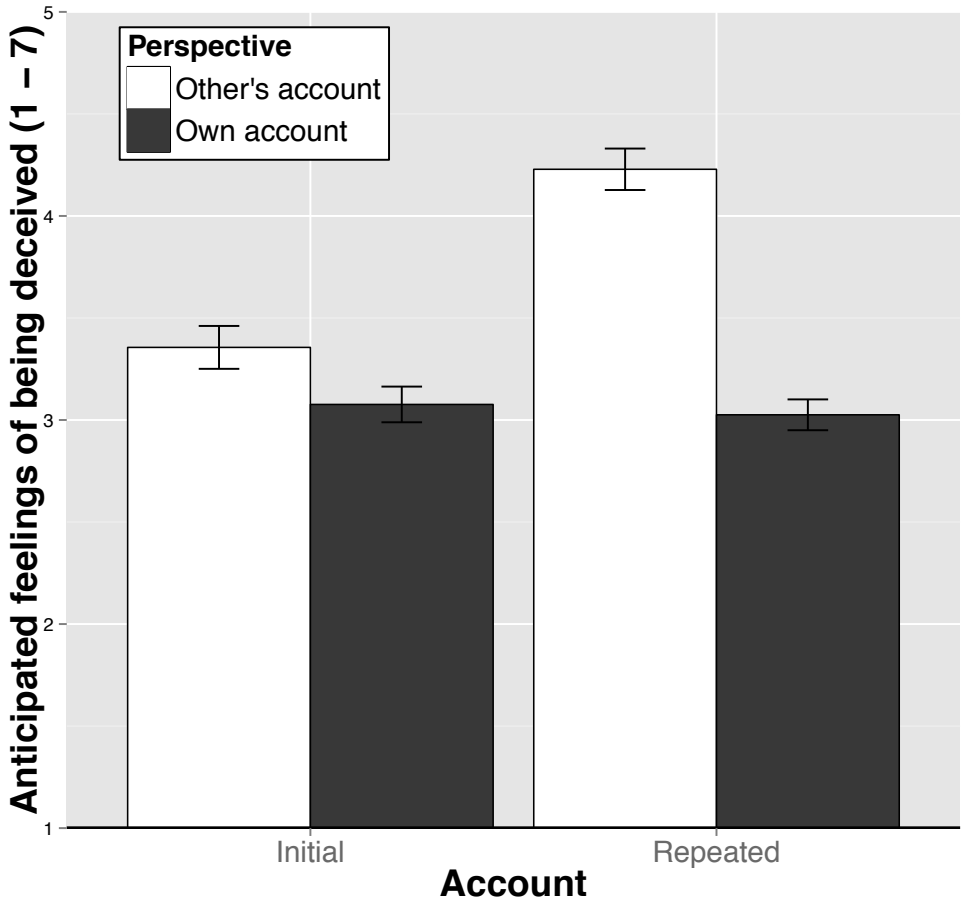

Figure 3.1. Anticipations of feeling deceived for both initial and repeated accounts by perspective. Error bars represent standard errors of the mean, calculated for data of within-subjects variables based on a procedure by Loftus & Masson (1994).

The veracity × account interaction (see Figure 3.2) showed that while for initial lies participants did not anticipate to feel lied to more or less (M = 3.71, SE = .14) than for repeated lies (M = 3.87, SE = .13; $F(1.232)$ = .89, p = .347, η_p^2 < .01, 95% CI [-.50, .18]), for initial truths participants anticipated to feel lied to less (M = 2.72, SE = .14) than for repeated truths (M = 3.38, SE = .13; $F(1, 232)$ = 14.95, p < .001, η_p^2 = .06, 95% CI [-.10, -.32]). Additionally, initial accounts were anticipated to come across less deceptively when truthful compared to when untruthful, $F(1, 232)$ = 24.15, p < .0001, η_p^2 = .09, 95% CI [-1.39, -.59]. Repeated accounts were also anticipated to come across less deceptively when truthful compared to when untruthful, $F(1, 232)$ = 6.88, p = .009, η_p^2 = .03, 95% CI [-.86, -.12].

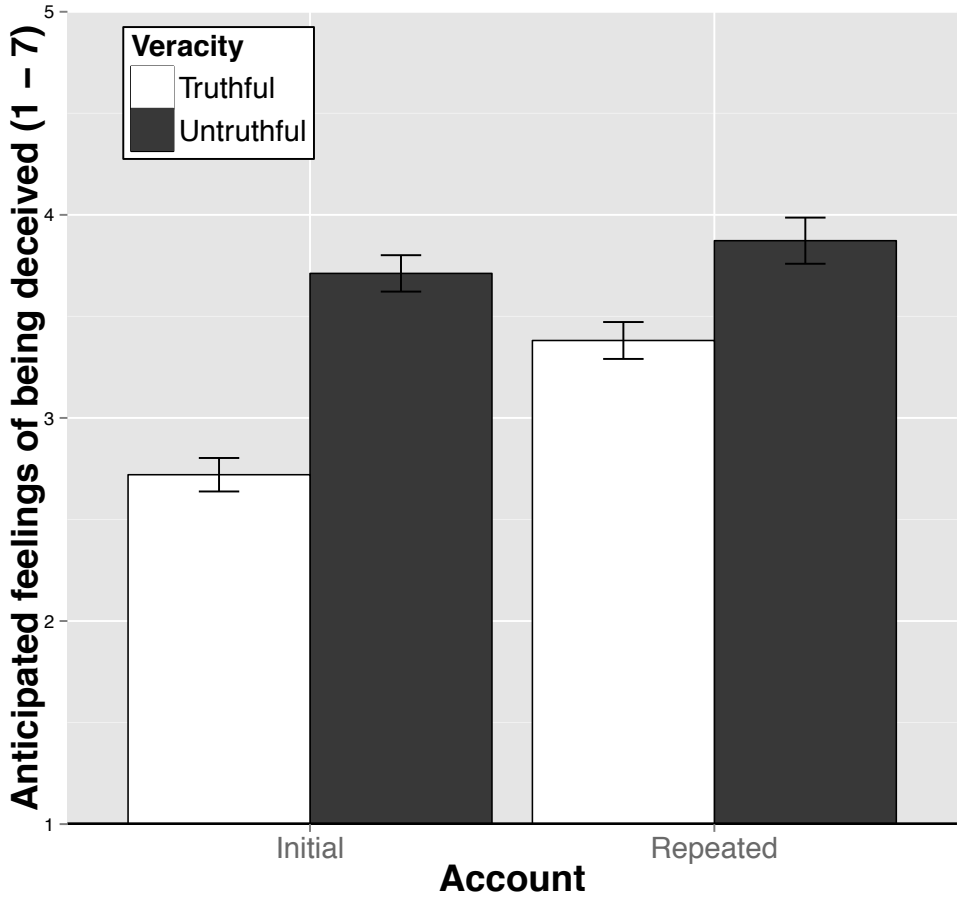

Figure 3.2. Anticipations of feeling deceived for both initial and repeated accounts by veracity. Error bars represent within-subjects standard errors of the mean.

Choice between which account is more deceptive. With a Generalized Linear Mixed Model we investigated the effects of perspective (self vs. other) and veracity (truth vs. lie) on the choice between whether an initial or a repeated account would feel more deceptive. Results indicated there was a main effect of perspective on choice, $F(1, 232) = 10.51$, $p = .001$, such that when selecting which account was more deceptive, participants who rated their own account selected their initial account more often (56.8%) compared to participants who rated the accounts of others (35.6%). There was also a main effect of veracity on choice, $F(1, 232) = 8.94$, $p = .003$, such that when selecting which account was more deceptive, participants rating truths chose the initial account less often (36.4%) than participants rating lies (55.9%). The interaction between perspective

and veracity on choice was not significant, $F(1, 131) = 1.90$ $p = .168$. See Figure 3.3.

Choice between telling the story right away and rehearsing it. With a Generalized Linear Mixed Model we investigated the effects of perspective (self vs. other) and veracity (truth vs. lie) on the choice between telling the story right away and rehearsing it. Results indicated there was no effect of perspective on choice, $F(1, 232) = 1.20$, $p = .27$, there was an effect of veracity on choice, $F(1, 232) = 10.97$, $p = .001$, and a marginally significant interaction between perspective and veracity, $F(1, 232) = 3.34$, $p = .069$. Participants rating others' accounts chose others would tell the story right away (55.9 %) about equally as often as participants rating whether they themselves would tell the story (61.9%). The effect of veracity showed that participants rating truths thought that stories would be told right away more often (59.5 %) than participants rating lies did (48.3 %). See Figure 3.4.

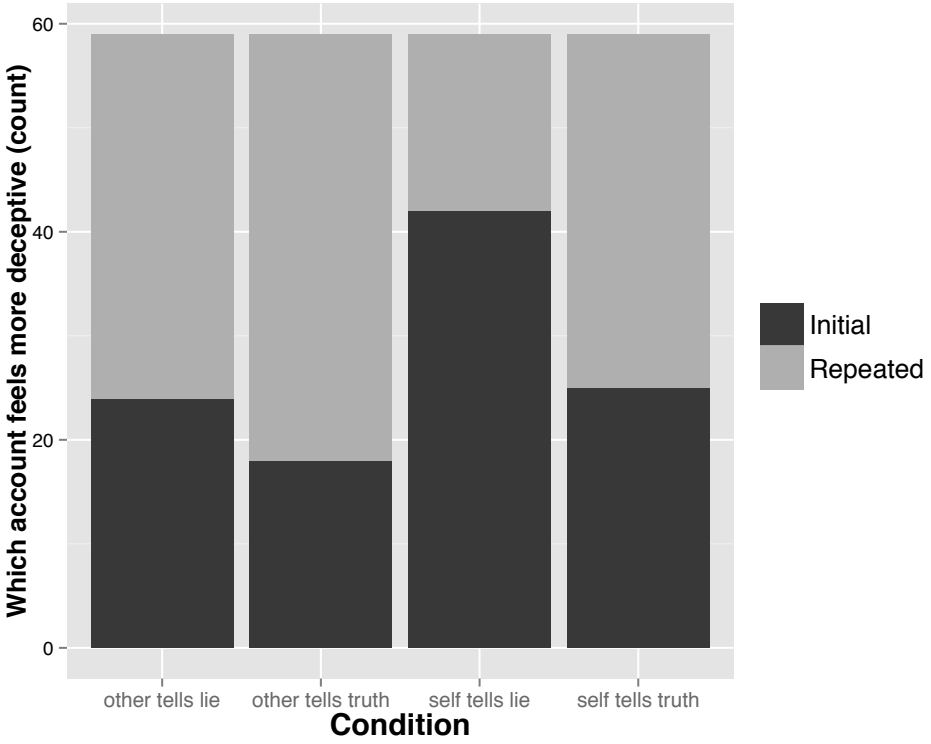

Figure 3.3. Distribution of forced choice between which account (initial vs. repeated) feels more deceptive, by condition.

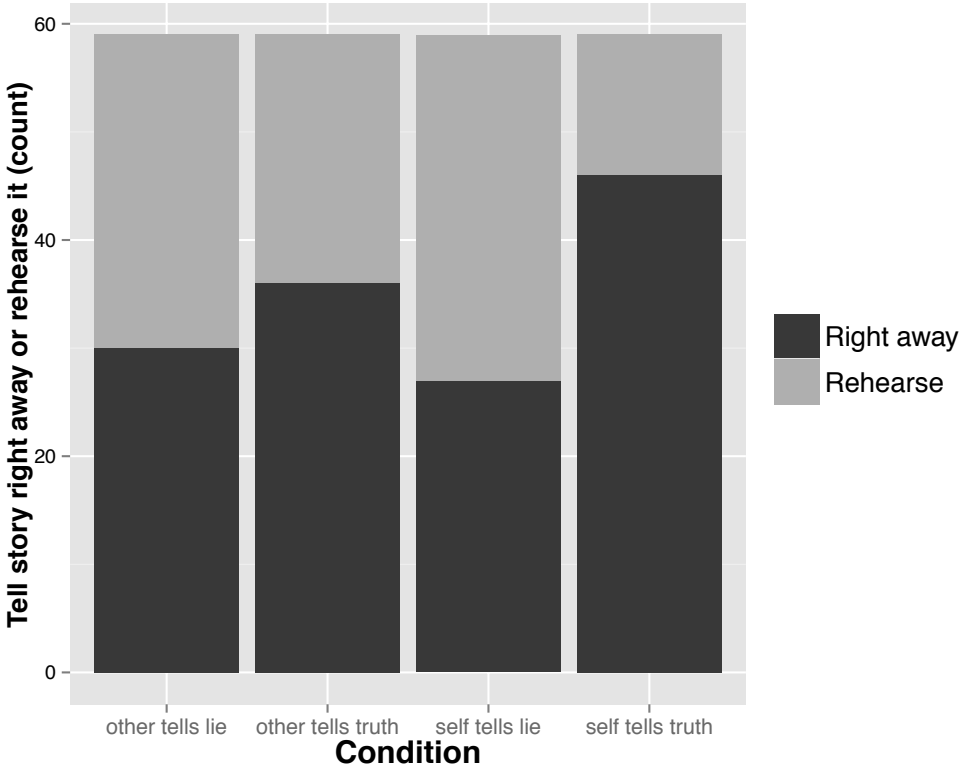

Figure 3.4. Distribution of forced choice between telling the story right away or rehearsing it, by condition.

Discussion

In Study 3.1 we explored participants' anticipations pertaining to whether an initial or a repeated account of the same story would come across more deceptive. Results showed that participants anticipated repeated truths to come across more deceptively than initial truths, whereas participants did not anticipate repeated lies to come across more deceptively than initial lies. This suggests that participants believe that trustworthiness is impaired for a rehearsed truth-teller compared to a spontaneous truth-teller, but that rehearsing does not impair the trustworthiness of a liar. In line with this, results of the choice between whether an account would be given right away or rehearsed indicate that truths were chosen to be told right away more often than lies. Furthermore, participants were either asked to imagine that they told the story or that another person told the story. Results indicated that participants believe that their own account would not be affected by rehearsing whereas the stories of others would be affected by rehearsing. Specifically, regardless of the veracity of the account, rehearsed accounts of others were believed to come across more deceptive than spontaneous accounts of others. In Study 3.2 we examined how the stories of others actually come across.

Study 3.2

In Study 3.2, we continued to examine veracity judgments by looking at participants' actual deception detection abilities for initial and repeated accounts. We tested whether—corresponding to the results of Study 3.1—a truth told initially compared to a truth told repeatedly comes across more honest, and whether a lie told initially compared to repeatedly comes across less honest. Moreover, we assessed veracity judgments in both a direct and an indirect way. For the direct veracity judgments, next to asking participants to choose between whether they believed a target to be lying or telling the truth, we asked participants to indicate how much they *felt* lied to. This may aid detection because research has shown intuitive judgments to outperform deliberated judgments (e.g., Albrechtsen et al., 2009). Importantly, because there is now some evidence that indirect

judgments distinguish liars from truth-tellers better than direct judgments (cf. Ulatowska, 2014; van 't Veer et al., 2014; Vrij et al., 2001), we aimed to test whether indirect measures still differentiate between truths and lies even if statements are repeated. Therefore, next to direct veracity judgments, we assessed several indirect veracity judgments. First of all, we assessed participants' confidence in their direct judgments (cf. DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997). Secondly, following prior research indicating that people believe liars show nervous behaviors and increase their movements (Vrij & Semin, 1996; Vrij & Mann, 2001), we assessed participants' impression of the targets' confidence, movement and nervousness as a measure of the ease of expression of the targets. And thirdly, because people readily differentiate others by their affinity for them (e.g., trustworthiness, warmth; Bonnefon, Hopfensitz, & De Neys, 2013; Fiske et al., 2007), we assessed an affective judgment, namely participants' liking of the targets.

Method

Participants and design. One hundred and forty seven Tilburg University students participated—94 females, M_{age} = 21.74, SD_{age} = 2.53—in return for course credit or money (€8 for the entire experimental hour). The study was run for the two weeks it was scheduled for, resulting in a big enough sample size to have over 80% power to find a small effect. We report all data exclusions (there were none), all manipulations, and all measures in the study. Participants were presented with four videos in which we randomly varied whether an account was given spontaneously or whether it was repeated, and whether a target person told the truth or lied, resulting in a 2 (account: initial or repeated) × 2 (veracity: truth or lie) within-subjects design.

Video material. Participants watched four videos that were sampled from sixteen videos of four targets (2 females, M_{age} = 22.08, SD_{age} = 0.27). Sampling was done in such a way that a given participant saw four different targets. Separate videos depicted the first or second recording of a truthful or deceitful answer by the target person to the question "Can you tell me what you day looked like yesterday?". Before each time a target person went into the video recording room—for the lie and truth separately—a first research

assistant randomly told the target person to either lie or tell the truth. The second research assistant who was in the recording room was unaware of truth/lie condition, and posed the same question twice in a row in order to first get a spontaneous answer and then a repeated answer from the same target person. Targets directed their answer to the second research assistant (who was sitting next to the camera) and went through their entire day, taking their time and freely correcting themselves if mistakes were made. The target person's full body was visible on the videos. The average duration of the videos was 1 minute and 9 seconds (*SD* = 34.29 seconds), which included the voice of the second research assistant posing the question. Truth and lie videos did not differ significantly in duration, and neither did recordings of initial and repeated accounts (all *t*s <1).

Procedure. Participants were first presented with all the questions they were going to answer about the target person in each video. This was done to keep knowledge of the questions comparable between the first and subsequent videos. Participants watched a total of four videos, however, this number was unknown to participants in order to avoid strategic answering. After each video we first asked participants to assess their own feelings of being deceived on a continuous direct veracity judgment: "Do you have the feeling that this was a lie?" (slider from 0 = *not a lie*, to 100 = *a lie*), followed by a binary direct veracity judgment: "If you had to choose, would you say this was mainly a lie or mainly the truth?" (binary judgment between "truth" or "lie"). Next, participants' indirect veracity judgments were assessed. First, participants indicated their confidence in the direct judgments: "How sure are you about this?" (slider from 0 = *not at all sure*, to 100 = *very sure*). Second, we assessed the impression of ease of expression a target person made. We asked about the target person's confidence: "To what extent did the person on the video come across confident?" (slider from 0 = *not at all confident*, to 100 = *very confident*), about the target person's nervousness: "To what extent was the person on the video nervous?" (slider from 0 = *not at all nervous*, to 100 = *very nervous*), and about the target person's movement: "How much movement did the person show?" (slider from 0 = *no movement at all*, to 100 = *a lot of movement*), α = .71. Third, as the last indirect veracity judgment we

assessed whether participants liked the target person: "To what extent do you like the person on the video?" (Slider from 0 = *not at all*, to 100 = *very much*). Demographics were ascertained (age, gender) and participants were asked whether they knew any of the targets[5].

Results

Direct veracity judgment: Feelings of being lied to. A 2(account: initial vs. repeated) × 2(veracity: truth vs. lie) repeated measures ANOVA on participants' feelings of being deceived revealed there was no main effect of account, $F(1, 146) = 1.48$, $p = .23$, $\eta_p^2 = .01$. There was a main effect of veracity, $F(1,146) = 6.95$, $p = .009$, $\eta_p^2 = .05$, which was qualified by an interaction between account and veracity, $F(1, 146) = 9.13$, $p = .003$, $\eta_p^2 = .06$. Subsequent pairwise comparisons indicated that when looking at initial accounts, participants felt lied to less by truth-tellers ($M = 27.49$, $SD = 24.55$) than by liars ($M = 39.85$, $SD = 30.63$), $F(1, 146) = 15.54$, $p < .001$, $\eta_p^2 = .10$, 95% CI [-18.56, -6.16]. For repeated accounts, there was no difference between truth-tellers ($M = 36.31$, $SD = 28.30$) and liars ($M = 35.62$, $SD = 26.01$), $F(1, 146) = .05$, $p = .82$, $\eta_p^2 < .001$, 95% CI [-5.33, 6.72]. Truth-tellers' initial accounts made participants feel lied to less than their repeated truth, $F(1,146) = 9.90$, $p = .002$, $\eta_p^2 = .06$, 95% CI [-14.37, -3.28]. For liars, the initial and repeated lie did not differ significantly, $F(1,146) = 2.08$, $p = .15$, $\eta_p^2 = .01$, 95% CI [-1.56, 10.03]. Figure 3.5 depicts the interaction between account and veracity.

[5] 15% of participants knew one or more of the targets. In- or excluding these participants in the analyses did not change the interpretation of the analyses. We report the analyses including all participants.

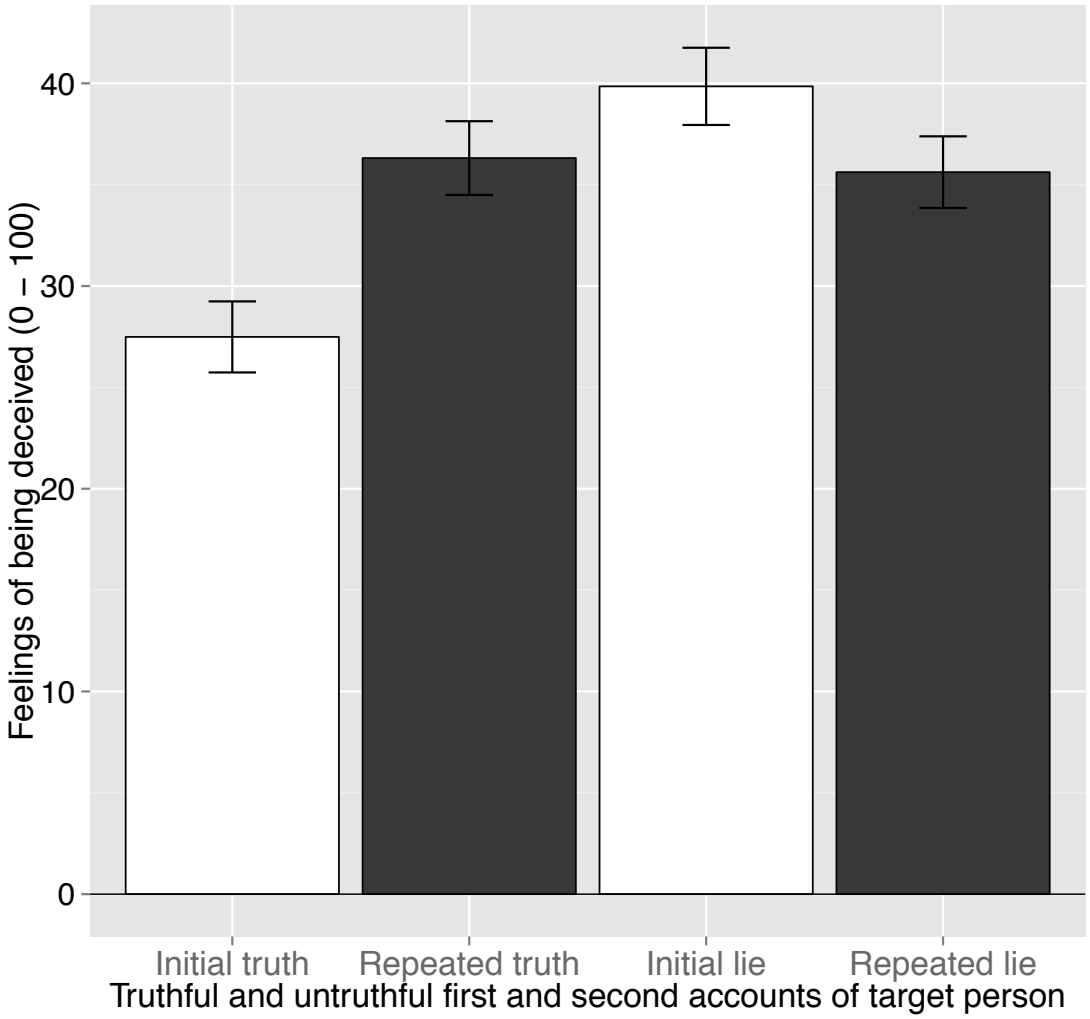

Figure 3.5. Participants' feeling of being deceived by account (initial or repeated) for both truthful and untruthful accounts. Error bars represent standard errors of the mean calculated for within-subjects.

Direct veracity judgment: Truth or lie. To examine the forced veracity choice, we performed a Generalized Linear Mixed Model with this direct veracity judgment as the dependent variable and both account and veracity as fixed factors. Results revealed no main effect of account, $F(1, 584) < .01$, $p = .97$, a main effect of veracity, $F(2, 584) = 6.54$, $p = .011$, and an interaction between account and veracity, $F(1, 584) = 6.54$, $p = .011$, confirming the above mentioned results that while initial accounts of lies were judged to be lies more often (34.7%) than initial accounts of truths (16.3%), lies and truths got judged to be a lie equally often when repeated (24.5%

and 24.5%). Overall, participants were correct 54.6% of the time, which was significantly different from chance, $t(146) = 2.44$, $p = .016$, $d = .20$, 95% CI [.87, 8.32].

Indirect veracity judgment: Confidence in veracity judgment. A 2(account: initial vs. repeated) × 2(veracity: truth vs. lie) repeated measures ANOVA on participants' confidence in their own veracity judgment revealed no main effects of account, veracity, nor their interaction ($F(1,146) = 1.94$, $p = .17$, $\eta_p^2 = .01$, $F(1,146) = 2.06$, $p = .15$, $\eta_p^2 = .01$, and $F(1,146) = .49$, $p = .48$, $\eta_p^2 < .01$, respectively). This suggests participants did not differ in their confidence when judging initial truths ($M = 65.08$, $SD = 24.27$), repeated truths ($M = 64.35$, $SD = 24.86$), initial lies ($M = 63.78$, $SD = 24.94$), and repeated lies ($M = 60.40$, $SD = 24.62$).

Indirect veracity judgment: Ease of target's expression. A 2(account: initial vs. repeated) × 2(veracity: truth vs. lie) repeated measures ANOVA on participants' impression of the targets' ease of expression revealed only a main effect of account, $F(1,146) = 10.17$, $p = .002$, $\eta_p^2 = .07$, and no main effect of veracity, $F(1,146) = .17$, $p = .677$, $\eta_p^2 < .01$, nor an interaction, $F(1,146) = 1.82$, $p = .180$, $\eta_p^2 = .01$. This suggests initial accounts come across with more difficulty ($M = 45.99$, $SE = .98$) than repeated accounts ($M = 42.17$, $SE = 1.01$; 95% CI [1.45, 6.20]).

Indirect veracity judgment: Liking the target person. A 2(account: initial vs. repeated) × 2(veracity: truth vs. lie) repeated measures ANOVA on participants' liking of the target person revealed a main effect of veracity, $F(1,146) = 13.31$, $p < .001$, $\eta_p^2 = .08$, and no main effect of account, $F(1,146) = .45$, $p = .51$, $\eta_p^2 < .01$, nor an interaction, $F(1,146) = .41$, $p = .52$, $\eta_p^2 < .01$, respectively), showing truth-tellers were liked more ($M = 61.85$, $SE = 1.13$) than liars ($M = 56.94$, $SE = 1.16$; 95% CI [2.25, 7.57]).

Discussion

In Study 3.2, we found that truth-tellers came across more deceptively during their repeated account compared to their initial account. The way that truth-tellers came across on their repeated

account was no longer distinct from the way liars came across. Irrespective of whether a truth or a lie was told, however, repeated accounts were judged to have more ease of expression than initial accounts. Irrespective of whether an account was given repeatedly or not, when targets lied they were liked less than when they told the truth. Taken together, Study 3.2 seems to suggest that for liars it is beneficial to tell their story repeatedly, whereas for truth-tellers, it is not.

General discussion

Narratives are an important aspect of people's lives and on many occasions, accounts of events are given repeatedly. Even so, the influence of retelling (un)true stories on the believability of the account has received little empirical attention thus far. Across two studies we found that detection of deception was anticipated to be and actually was more difficult for repeated stories than for initial accounts of the same stories. Moreover, we showed that it is essential to distinguish between direct and indirect veracity judgments. Specifically, a direct judgment that asked participants to indicate whether they thought the target was lying no longer distinguished between liars and truth-tellers when their stories were repeated. This suggests that knowing whom to trust is best assessed from initial unrehearsed stories, because, for these instances, the feeling of being deceived is still on the right course to set apart liars from truth-tellers. The indirect, affective judgment of liking the target person, in contrast, distinguished between liars and truth-tellers for both the initial and the repeated accounts of their stories. This finding suggests that affective judgments, such as liking another person, seem to endure as appropriate guides to sincerity even though stories are repeated and the storyteller comes across with more ease of expression during this repetition.

The results of actual feelings of being lied to while attempting to detect deception were not entirely in line with the anticipations of this feeling that we found in Study 3.1. Repeated accounts of others—but not of the participants themselves—were anticipated to feel more

deceptive then initial accounts, irrespective of whether the account was true or false. In Study 3.2, results indicated that repeating a lie turned out to be beneficial for the liar, as repeated lies no longer came across more or less deceptive than repeated truths. In Study 3.1, irrespective of whether they themselves or another person told the story, participants anticipated the listener to feel deceived especially during repeated truths compared to during initial truths. Repeated lies, in contrast to this, were not anticipated to come across more or less deceptively than initial lies. These anticipations do resonate with actual ratings of feeling deceived in Study 3.2. Furthermore, participants in Study 3.1 chose their own initial lies to come across more deceptively than their repeated lies, and their own repeated truths to come across more deceptive than their initial truths. Additionally, the majority of participants in Study 3.1 indicated they would not rehearse their own true stories—both these anticipations seems to be good practice according to the findings in Study 3.2. Connecting both studies, the findings suggest that intuitions about coming across honestly suit actual detection performance best when these intuitions are provided about one's own feelings and behavior. We think it is likely that this is the case because people have more accurate information on the veracity and the repetition of their own stories.

Practical implications

Our results have implications for situations where stories or statements are told repeatedly. When direct veracity judgments are made, for instance when people are actively trying to tell whether they are being deceived, truth-tellers who repeat their story may be mistaken for a liar. We did find some benefits to telling a true story, and even to telling it repeatedly. Truth-tellers were liked more than liars, and on top of this, during their repeated account they left a more positive impression in terms of their ease of expression—as measured by their confidence, nervousness and amount of movement—than during their initial account. Even so, repeated accounts of the truth came across more deceptively than initial accounts of the truth. Because for liars this pattern was reversed, together this resulted in repeated truths no longer making the listener feel any more or less

deceived then repeated lies did. A possible explanation could be that truth-tellers devote resources to both recalling the actual events and recalling the first time they told their story. Additionally, attention may be devoted to, for instance, controlled impression management. Repeated truths may reflect more deliberated processes, whereas spontaneous truths are fairly automatic. The unrehearsed truth may therefore come across more sincere than a rehearsed truth.

For liars, on the other hand, it seems beneficial to repeatedly tell a story. Repeated stories have more ease of expression than stories that are told for the first time, and repeated lies may no longer be distinguishable from repeated truths. It seems likely that once a lie is thought-up, merely reiterating what was said before is fairly effortless. The current research has focused on relatively small and inconsequential lies. Once lies become more elaborate and lie-catchers start to ask difficult questions, liars will likely have to expand more and more effort to keep consistent (e.g., Vrij & Granhag, 2012). It is especially noteworthy that even with the small lies that were studied here, liars did pay a price for their deception: They were liked less than truth-tellers. Outside of the lab, depending on the purpose of a lie, being liked less may be a small price to pay. However, it is unclear whether this brings along long-term consequences for liars. People who follow their gut may, for instance, be less inclined to trust or engage with those who are deceiving them.

Indirect veracity judgments

Our findings have important implications for researchers who study lie detection. This is often studied by trying to find cues that liars display (e.g., DePaulo et al., 2003; Ekman, 2003; Levine et al., 2011), looking at manipulations aimed at eliciting cues from the liar (e.g., Debey, Verschuere, & Crombez, 2012; Vrij & Granhag, 2012), and individual difference measures within observers (e.g., Bond & DePaulo, 2008; Reinhard, 2010). As the current research suggests, it is likewise valuable to study the conditions under which targets tell their story (i.e., whether it is rehearsed) and the conditions under which veracity judgments are made (i.e., whether the observer is asked to judge veracity directly or indirectly). The different types of indirect measures that were assessed here aimed to add to the

literature by disentangling participants' impressions of the ease of expression of a target person and participants' affective reactions towards the target person. Indeed, these indirect measures showed different patterns.

Our results did not reveal a difference between liars and truth-tellers on how fluent the stories came across, suggesting that it is not the fact that liars come across more disfluent that causes them to be liked less than truth-tellers. The question is what it is exactly that causes individuals to be liked more when they are telling the truth compared to when they were lying. This result seems to be a robust finding, as it is in line with research showing that likeability is negatively related to the amount of lies people tell in a 10 minute get-acquainted conversation (Tyler, Feldman, & Reichert, 2006). Furthermore, this finding replicates previous studies (van 't Veer et al., 2014; van 't Veer, Gallucci, Stel, & van Beest, 2015). Future research could further investigate this. We think it is conceivable that the different patterns of indirect measures point at separate processes underlying reliance on appearance (i.e., deliberate assessments of cues; targets repeating their account always came across with more ease of expression) and reliance on character assessments (i.e., intuitive assessments of warmth; targets who lied were always liked less).

When our participants were asked to detect deception directly, they no longer distinguished truth-tellers from liars when stories were rehearsed. These findings resonate with established findings in the literature suggesting that with direct veracity judgments liars and truth-tellers are not readily distinguishable (Bond & DePaulo, 2006). The fact that for the initial stories we did find that liars made participants feel more deceived than truth-tellers may be due to a combination of several factors. The question we asked to assess participants' direct veracity judgment was framed in terms of 'feeling deceived' and this framing in terms of feelings may have induced participants to answer more in line with their gut feeling towards the targets. Next to this, targets displayed on the videos were not told the question they would be asked beforehand. The initial stories were therefore not thought-out beforehand, and contained the targets' spontaneous reactions. It is important for future research to keep this

in mind when developing video material. At the very least, it seems good practice to report the procedure leading up to the video material in enough detail for others to evaluate the spontaneity—or lack thereof—of the statements.

When investigating the detection of deception, it is important to resemble real life situations in which both liars and truth-tellers are sufficiently motivated to come across honest. For the purposes of the current chapter, we used a situation in which we expected minimal interference of complicating factors: Giving an account of what one did yesterday. Most people can remember their activities of the day before with a moderate amount of effort, and this gives a baseline on top of which anything that draws upon additional cognitive resources would have a fair chance of coming to light. The magnitude of these lies resemble real life, as most lies are small and of little consequence (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). However, this does not permit generalization to applied settings or advice on how to interview suspects, which we suggest could be a valuable avenue for future research. For example, suspects are often asked to repeat their statements several times. It therefore seems important to fully understand the impact of this repetition on how a suspect is perceived by law enforcement officers as well as judges.

Although far removed from any interrogation setting, the current research borrows from research agenda's set by others who argue that deception detection research should move towards paradigms that build on basic cognitive research approaches (Bond, 2012; Lane & Vieira, 2012). Investigating the circumstances under which potential liars' working memory and processing speed is hampered could ultimately lead to knowledge that is useful in practice: it is in these situations that cues to deception are argued to be elicited and enhanced (Vrij & Granhag, 2012). Combining assumptions about the cognitive processing of the target person with indirect and intuitive judgments of the observer—as was done in the current chapter—seems especially constructive.

Conclusions

Conclusions that can be drawn from the current chapter have implications for narrators as well as for listeners. As it was found that truth-tellers' repeated account of their story left an impression comparable to that of a liar, rehearsing the truth can be disadvantageous. This may be due to truth-tellers needing more cognitive effort and concentration when they repeat their story, which in turn makes truth-tellers more likely to be mistakenly taken for a liar. In contrast, when retelling a lie that was—almost as per definition—supposed to be remembered well, the impression one gives off seems to benefit from repetition. To get a feeling of whether someone is lying, it is best to catch the spontaneous account of his or her statement. Yet even though it may be favorable to listen to a spontaneous story, one cannot always be sure whether a story is indeed told for the first time. For this reason, and as can be inferred from the current research, it seems that judging whether someone is deceptive is best served by relying on affective, intuitive responses.

Chapter 4
Reliance on effortless modes of processing when detecting honesty

Correctly deciding whom to trust on the basis of other people's (dis)honesty is a valuable skill in life. In the current chapter we hypothesized that detection of dishonesty may be enhanced under stress. In a pre-registered experiment, participants (N = 169) detected deception from videos with both a direct veracity judgment (i.e., is the target lying?) and an indirect veracity judgment (i.e., is the target trustworthy?). During this task, participants in the stress condition anticipated giving a public speech, while participants in the control condition did not. Results indicated that stress did not facilitate the ability to detect deception on direct measures. However, indirect detection did seem to be facilitated by stress. Under stress, participants judged truth-tellers to be more trustworthy than liars. Results are discussed in terms of the automaticity of trustworthiness judgments from dynamic information of targets presented to observers.

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Chapter 4: Reliance on effortless modes of processing when detecting honesty

People make decisions about whether to trust others on a daily basis. Being able to tell apart a lie from the truth is therefore a valuable skill. In the evolutionary race between the deceiver and the deceived, the deceiver is thought to be one step ahead: once a new way to detect deception has been established, the deceiver comes up with a new method to hide the truth (Trivers, 2011). Correspondingly, when people are consciously attempting to detect a liar, they are led astray most of the time (Bond & DePaulo, 2006). Intriguingly, theoretical accounts do assume people have an inborn module to identify cheaters (Cosmides, Barrett, & Tooby, 2010)—a mental faculty that is less reliant on cognitive processing. Analogous to this, indications that humans possess an unconscious, automatic ability to detect deception are emerging in the literature (Albrechtsen, Meissner, & Susa, 2009; ten Brinke, Stimson, & Carney, 2014). In some situations—for instance when meeting a stranger who may be friend or foe—it is more important to form an accurate impression of others' intentions than in other situations. If these situations also call for a greater reliance on automatic responding, this in turn may increase relevant intuitions about whom to trust. It can be suspected that the ability to detect deception is particularly important under circumstances that involve novelty, lack of control, or unpredictability—in short, circumstances that induce stress (Mason, 1968). Accordingly, in the current chapter we aim to test the influence of stress on people's ability to detect deception directly (i.e., with a lie/truth judgment) and indirectly (i.e., with a trustworthiness judgment).

Deception detection under stress

Stress triggers neural responses that permit an adaptive and fast response to the situation—often referred to as a 'fight-or-flight' response (Cannon, 1914). Situations involving stress are often uncertain and usually offer a trade-off between a first intuitive

reaction and a deliberate revision of that reaction. This means that brain regions that are associated with emotional-intuitive and rational-analytical decision-making are divergently impacted by stress. Decision-making strategies that are controlled and take up more processing capacity are thought to be hindered, while automatic responses are left relatively unaltered. Stress can thus lead to less deliberative processing (Starcke & Brand, 2012). For example, stress is associated with more premature closure and non-systematic scanning (Keinan, 1987), meaning that during a decision there is little consideration of alternative options. This is corroborated by studies finding that stress impairs prefrontal cortex (PFC) function (Qin, Hermans, van Marle, Luo, & Fernández, 2009) and decreases working memory performance (Schoofs, Preuss, & Wolf, 2008). Indeed, stress has often been found to undermine performance on laboratory tasks where analytical thinking would lead to better outcomes (Keinan, 1987; Starcke & Brand, 2012).

There are, however, numerous situations in which automatic processing may lead to better outcomes. One such situation is when people judge other people's character (e.g., Ambady, 2010). For instance, judging the trustworthiness of economic partners is not impaired by concurrent cognitive load, and is independent of intelligence (Bonnefon, Hopfensitz, & De Neys, 2013). Additionally, having concurrent cognitive load seems to aid deception detection, suggesting that an automatic processing style may lead to more accurate deception detection than a deliberate processing style (Albrechtsen, et al., 2009; Feeley & Young, 2000). Furthermore, various findings suggest that subjective, unconscious, and indirect veracity judgments result in more accurate discrimination between liars and truth-tellers than their more deliberated and direct counterparts (DePaulo et al., 2003; Reinhard, Greifeneder, & Charmach, 2013; van 't Veer, Gallucci, Stel, & van Beest, 2015; Vrij, Edward, & Bull, 2001). In short, provided that stress leads to relatively more automatic processing, it is likely that stress should have comparable beneficial effects on deception detection performance to other factors that hinder deliberation.

Next to the enhancing reliance on automatic processing, stress might also enhance the ability to tell whether someone's intentions are

genuine through a more sensitized detection of social cues. In a stressful environment, it could be adaptive to direct attention to relevant signals. When experiencing stress, it seems to be the case that priority is given to the processing of emotional stimuli. For instance, stress increases neural activity and reaction times for emotional stimuli (Li, Weerda, Milde, Wolf, & Thiel, 2014) and directs attention to these stimuli at the cost of working memory performance (Oei et al., 2012). Sensitivity to social cues is also heightened during other kinds of stressful negative experiences, such as social exclusion. After recalling the stressful experience of being rejected, people seem to be better able to discriminate true smiles from deceptive smiles (Bernstein, Young, Brown, Sacco, & Claypool, 2008). As it can be costly for rejected individuals to affiliate with dishonest others, it seems they are better able to detect this dishonestly. Similarly, when under stress, it would be most advantageous to direct affiliation and cooperation efforts towards individuals who have genuine intentions. Truth-tellers, compared with liars, may leave a more positive impression because their emotional expressions are genuine. Although meta-analyses indicate that there are few reliable cues that liars portray, if anything, they come across more tense and less forthcoming than truth-tellers (DePaulo et al., 2003). Liars may also 'leak' the emotional states they are attempting to suppress (Ekman & Friesen, 1969). In short, a person who experiences stress could more readily perceive the emotions—however fleeting—that differentiate a truth-teller from a liar.

Indirect veracity judgments

As mentioned above, there is no single distinct cue that informs observers that they are being lied to. Nevertheless, a combination of factors seems to leave an overall impression that 'something about this person is off'. One possible explanation for this is that this impression is based on signals of the genuineness with which a message is portrayed. Frank, Ekman, and Friesen (1993) showed participants videos of targets who displayed genuine Duchenne smiles as well as targets who displayed faked non-

Duchenne smiles. Results of a composite measure of trait ratings that together formed a general positivity scale revealed that participants' impression of the person they saw was more positive if this person displayed Duchenne smiles rather than non-Duchenne smiles. Moreover, research by Tyler, Feldman, and Reichert (2006) showed that the number of lies that were told during a short interaction was negatively related to liking. Importantly, direct comparisons between impressions of a target person who lies and a target person who tells the truth also reveal that liars are liked and trusted less (van 't Veer et al., 2015; van 't Veer, Stel, van Beest, & Gallucci, 2014). These kind of positive and negative impressions that are born out of honest and dishonest interactions may be the very reason why indirect veracity judgments—the kind of judgments that do not require an assessment of whether deception takes place—appear to distinguish truth-tellers from liars.

Trustworthiness detection

Of the many ways that deception detection could be assessed indirectly, trustworthiness judgments seem to be the most promising. Impressions of the warmth and trustworthiness of another person have been argued to be fundamental and important for survival (Fiske, Cuddy, & Glick, 2007) and a growing body of research suggests that people automatically perceive trustworthiness from faces (Bonnefon, et al., 2013; Todorov, Pakrashi, & Oosterhof, 2009; Todorov, 2008; Willis & Todorov, 2006; Winston, Strange, O'Doherty, & Dolan, 2002; Yang, Qi, Ding, & Song, 2011). This research in the area of trustworthiness detection has focused mostly on showing participants still pictures in which, for instance, facial features related to perceived trustworthiness are manipulated (e.g., Stirrat & Perrett, 2010; Todorov, Baron, Oosterhof, 2008). However, this does not take into account the fundamental aspect of social behavior that actions are influenced by the situation. The same person may be dishonest in one situation, and entirely honest in another. From the literature on behavioral economics it is known that dishonest behavior is not just present in a few immoral people, but that most people can be tempted

to display dishonest behavior given certain circumstances (Mazar, Amir, Ariely, 2008). Accordingly, if people were to trust others around them sensibly, they would not just rely on their ability to detect cheater personalities or stable facial features, but on an impression formed when observing a person who, in a given situation, has decided to betray trust.

There are several indications that information from situation-related expressions may be informative to the detector. For instance, people can distinguish cooperators from non-cooperators when viewing a picture that was taken at the moment the target was thinking about the decision to cooperate or not (Verplaetse, Vanneste, & Braeckman, 2007). Additionally, this ability seems to be stronger than the ability to detect trustworthiness from faces that were not taken during the decision (Bonnefon, et al., 2013). Furthermore, it has been argued that the ability to detect trustworthiness from a neutral face is an extension of the ability to have a functional reaction towards emotional expressions (Oosterhof & Todorov, 2009; Todorov, 2008). A study by Frank and Ekman (2004) showed that for any given individual, the skill to appear honest during a videotaped interrogation is likely consistent over different deception situations. This perceived truthfulness was found to be driven by dynamic facial actions, and was not related to truthfulness judgments from pictures of the targets' neutral expression (Frank & Ekman, 2004). Emotional expressions and other non-verbal behavior, evidently, are likely to be present more in videos or real life interactions rather than in static pictures. This is further demonstrated by findings suggesting that people predict cooperation of others better after a face-to-face interaction than after a computer mediated chat interaction, and that a combination of non-verbal behaviors displayed by the interaction partner predicts trustworthiness (DeSteno et al., 2012).

Because we believe that judgments made on the basis of more information than just facial features could provide additional insights into trust behavior, we focused on trustworthiness judgments as an indirect measure of deception detection from videos taken of liars and truth-tellers. Trustworthiness judgments are suggested to be fairly automatic, yet it is unclear whether the additional information presented in a video could help or hinder this automatic response. On

the one hand, it has been found that adding more information to the picture of the face (i.e., pictures that reveal hairstyle and clothing) impairs trustworthiness detection (Bonnefon et al., 2013). On the other hand, while watching videos that by definition convey more information, the ability to detect deception directly is enhanced under cognitive load (Albrechtsen et al., 2009). Additional reliance on automatic processing may therefore be beneficial when watching videos with a rich variety of information. Here, we test whether people's ability to detect dishonesty and untrustworthiness from videos is enhanced under stress due to its presumed effect of increased reliance on automatic processing.

The current research

Taken together, different pieces of evidence lead to the same prediction: the ability to detect deception could be enhanced under conditions of psychological stress. A pre-registration of this hypothesis can be found online (see: https://goo.gl/7LSruw). We aimed to test whether stress would positively impact the ability to discriminate between liars and truth-tellers when the veracity judgment is assessed in a direct as well as an indirect way. Importantly, each measure could show an independent effect of stress because these measures can operate separately (Ulatowska, 2014). Therefore, participants were asked to judge whether they think a target person is lying (a *direct* veracity judgment) as well as how trustworthy they believe the target person to be (an *indirect* veracity judgment). We explored whether either of these measures would be enhanced under stress. On the one hand, direct deception detection is typically not very accurate and therefore stands a lot to gain, as evidenced by a higher accuracies found under cognitive load (Albrechtsen et al., 2009). The direct measure could also outperform indirect measures due to the fact that indirect measures already rely on an automatically formed judgment and therefore may not allow for much improvement in a situation where the tendency to rely on automatic processing is high. On the other hand, as mentioned above, it may be argued that indirect measures perform better than direct measures, and that is

especially so in a stressful situation where knowing whom to trust is consequential.

Method

Participants

A total of 190 Tilburg University students participated in return for course credit. We applied the planned stopping rule of running the study for a full week, which resulted in the sample size exceeding our planned minimal sample size of 150. Twenty-one participants (11%) were excluded on the basis of our pre-defined exclusion criteria: Three participants did not take part in the stress manipulation (i.e., giving a presentation), an additional 10 participants did not believe the manipulation, and an additional eight participants knew one of the targets (analyses including these participants did not change the interpretation of the results, see analyses provided on the Open Science Framework). The final sample consisted of 169 participants (134 females, 2 unknown), M_{age} = 19.59, SD_{age} = 2.10.

Procedure

Before watching videos with the goal of detecting deception, participants were randomly assigned to either a stress or a no stress condition. Participants in the stress condition were asked to prepare a public speech; participants in the no stress condition were asked to think of positive and negative aspects of their previous holiday. This standardized paradigm for laboratory settings reliably induces moderate psychosocial stress in the stress condition (e.g., Preston, Buchanan, Stansfield, & Bechara, 2007; Starcke, Wolf, Markowitsch, & Brand, 2008; Steele & Josephs, 1988). All participants were then presented with eight videos of around 20 to 30 seconds. The videos displayed a target person talking about their identity. The videos were selected out of a total set of 16 videos. The total set of 16 videos contained two video recordings of eight targets: One truthful and one deceitful message per target. We ensured that participants never rated the same target twice and that all participants rated four truthful and four deceitful messages (for details on the video material, see van ’t

Veer, et al., 2014). Participants were told beforehand that for each of the videos they would see during this task they would have to form an impression of the target person on the video by rating their trustworthiness and veracity. Participants were not informed about the number of videos in order to reduce the tendency to judge half as a lie. Indirect deception detection was measured with the question: "How trustworthy do you judge this person to be?" (slider-scale from *not at all trustworthy [0]* to *very trustworthy [100]*, numbers not visible to participants). Following this, direct deception detection was measured with the question: "Do you think this person lied?" (forced choice; *yes* or *no*).

After participants judged eight targets, we assessed both mood and anxiety as a check of our stress manipulation. Mood was assessed with one item: "At this moment I feel: *very negative – very positive*" (slider-scale from 0 to 100, numbers not visible). Next, the state part (20 items) of the State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1977) was assessed. The state part of the STAI is typically used as a manipulation check for stress manipulations (see Starcke & Brand, 2012), and includes items like "I am tense" and "I feel pleasant" (reversed coded) using a 4 point Likert-type scale ranging from 1 (*Not at all*) to 4 (*very much so*). Next, participants were asked whether they recognized any of the targets and subsequently demographics were ascertained.

We decided to have participants give an actual speech at the end of the experiment. This ensured that we did not have to deceive our participants and also prevented participants from spreading possible disbelief about our stress manipulation. Therefore, after providing demographic information and after completing an unrelated experiment that also relied on our stress induction, participants performed the speech. After the speech, participants again filled out the mood item as well as the STAI, allowing us to test whether their anxiety levels were back to normal. Note that we only assessed mood and the STAI a second time in the stress condition because participants in the control condition did not have to give a speech and therefore their stress levels were assumed to stay relatively stable over the course of the experiment.

Results

Below we first report the analyses that we planned to do to (1) check our manipulation and (2) to test whether stress affects deception detection abilities. After this, we report additional analyses on (3) stress levels after the experiment that we did not register upfront.

Manipulation checks

To check the stress manipulation, we compared the mean STAI scores with an independent samples t-test. Results confirmed that stress was higher in the stress condition (M = 44.73, SD = 11.08) than in the control condition (M = 36.88, SD = 8.08), $t(141.32) = 5.18$, $p < .0001$, $d = .82$, CI [4.85; 10.84]. We also explored the difference in mood with an independent samples t-test. This revealed that participants in the stress condition felt less positive (M = 53.52, SD = 19.67) than participants in the control condition (M = 64.10, SD = 16.69), $t(164) = -3.75$, $p < .0001$, $d = .59$, CI [-16.16; -5.01].

The influence of stress

Indirect veracity judgment. Trustworthiness judgments in both conditions for truth-tellers and for liars are displayed in Figure 4.1. As planned, we ran a mixed design ANOVA with trustworthiness as the dependent variable, condition as a between-subjects predictor and veracity of the target person as a within-subjects predictor. Results of the mixed design ANOVA revealed a main effect of veracity of the target person, $F(1, 165) = 4.74$, $p = .031$, $\eta_p^2 = .028$, indicating that liars were rated lower on trustworthiness (M = 56.30, SE = 1.07) than truth-tellers (M = 58.73, SE = 1.00). There was no main effect of condition, $F(1, 165) = .76$, $p = .39$, $\eta_p^2 = .005$, and no interaction between veracity and condition, $F(1, 165) = 1.73$, $p = .190$, $\eta_p^2 = .010$.

The interaction effect in the Mixed Design ANOVA on trustworthiness indicated that the difference between differences for liars and truth-tellers per condition was not significant. Because we predicted trustworthiness detections to be present under stress (i.e., a difference between trustworthiness judgments for liars and truth-

tellers under stress), we ran pairwise comparisons to examine trustworthiness detection within each condition. Pairwise comparisons indicate that in the stress condition liars were rated lower on trustworthiness (M = 56.33, SE = 1.55) than truth-tellers (M = 60.22, SE = 1.46), $F(1, 165) = 5.79$, $p = .017$, $\eta_p^2 = .034$, whereas in the control condition liars were not rated differently on trustworthiness (M = 56.27, SE = 1.47) than truth-tellers (M = 57.23, SE = 1.38), $F(1, 165) = .39$, $p = .533$, $\eta_p^2 = .002$. This observed pattern is in line with an ability to distinguish truth-tellers from liars under stress. See Figure 4.1.

Direct veracity judgment. In table 4.1 we present the frequency of the direct veracity judgments (i.e., judging a target to be truthful or deceitful) as a function of the veracity of the target (liars vs. truth-tellers) and condition (stress vs. control). The overall detection accuracy was 54.49%. A one sample t-test indicated that this overall accuracy was higher than chance, $t(166) = 3.321$, $p = .001$, $d_z = .26$, CI [.0182; .0716]. This accuracy rate is comparable to the accuracy rate of 53.98% found in a meta-analysis (Bond & DePaulo, 2006).

As planned, we ran a Generalized Mixed model to test the effect of the target's veracity and condition on whether a message was rated as a truth. Results revealed a significant effect of veracity of the target person, $F(1, 1332) = 11.58$, $p < .001$, indicating that truth-tellers were more likely to be judged to be truth-tellers (69.76%) than liars were (60.78%). There was no effect of condition, $F(1, 1332) < .01$, $p = .984$, and no interaction between veracity and condition, $F(1, 1332) = 0.38$, $p = .535$.

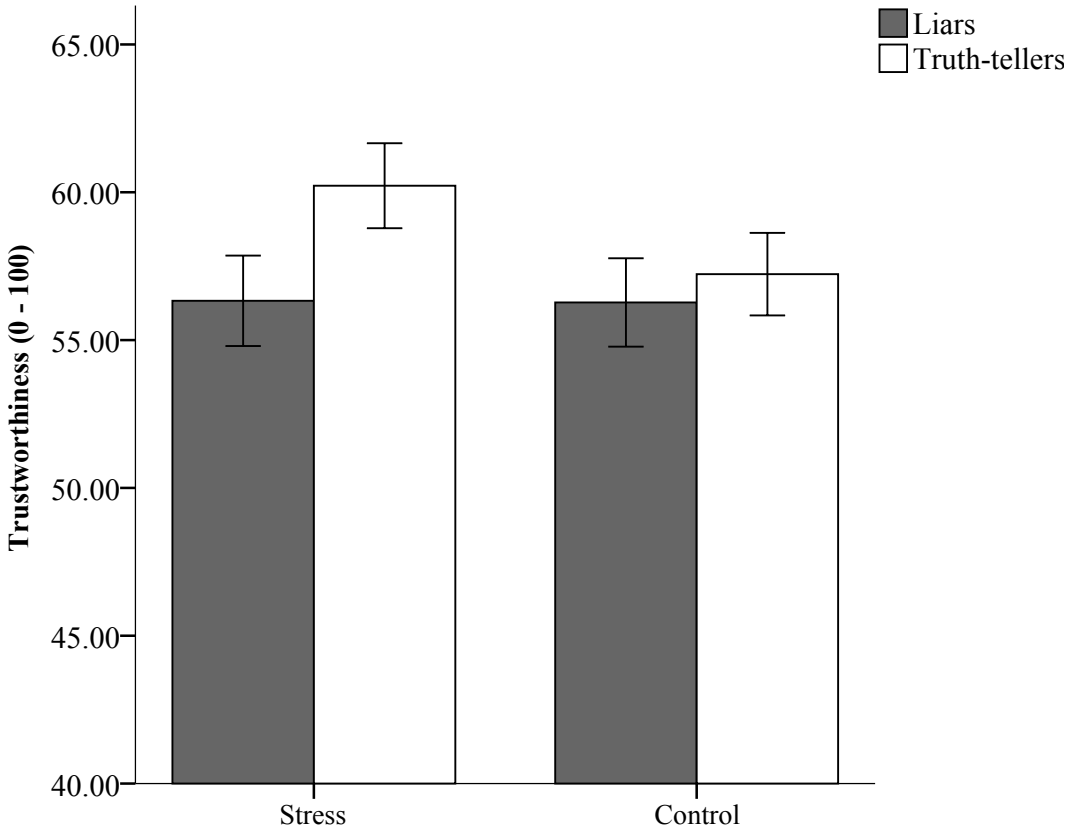

Figure 4.1. Trustworthiness judgments for liars and truth-tellers by condition. Error bars represent +/- 1 SE.

Table 4.1
Frequency (and percentage) of participants' direct veracity judgments by target's veracity and condition

		Target's veracity	
Condition		Liar	Truth-teller
Stress	Truth judgment	195 (30.85%)	218 (34.5%)
	Lie judgment	121 (19.15%)	98 (15.5%)
Control	Truth judgment	211 (29.95%)	248 (35.25%)
	Lie judgment	141 (20.05%)	104 (14.75%)

For the direct veracity judgment, we also tested the difference in the frequency of truth judgments for liars compared with the frequency of truth judgments for truth-tellers per condition. Pairwise comparisons indicate that in the stress condition liars were judged to be a truth-teller less often (61.70%) than truth-tellers (69%), $F(1, 630) = 3.69$, $p = .055$. In the control condition liars were also judged to be a truth-teller less often (59.90%) than truth-tellers (70.50%), $F(1, 165) = 8.52$, $p = .004$. This observed pattern is markedly different from the pattern we found for the indirect measures. These tests show that for both the stress condition (although marginally significant) as well as the control condition, liars were judged to be truth-tellers less often than truth-tellers, indicating that participants did have a slight tendency to give the right veracity judgments (as is also evidenced by the above-mentioned overall accuracy).

Stress levels after the presentation. We conducted additional analyses to verify that participants' anxiety level and mood in the stress condition would return back to baseline after the presentation. A paired samples t-test indicated that stress levels were indeed higher before the presentation ($M = 44.64$, $SD = 11.13$) compared with after the presentation ($M = 38.58$, $SD = 9.54$), $t(77) = 4.86$, $p < .0001$, $d_z = .55$, CI [3.58;8.55]. Similarly, a paired samples t-test indicated that mood was more negative before the presentation ($M = 53.99$, $SD = 19.35$) compared with after ($M = 60.49$, $SD = 20.88$), $t(77) = -2.78$, $p = .007$, $d_z = .31$, CI [-11.15; -1.85].

An additional independent samples t-test indicated that after the presentation both the anxiety level and mood of the participants in the stress condition was no longer significantly different from the anxiety level and mood of participants in the control condition, $t(164) = 1.24$, $p = .218$, $d = .19$, CI [-1.01;4.39] and $t(163) = -1.23$, $p = .219$, $d = .19$, CI [-9.40;2.17], respectively. This suggests that participants in the stress condition left the experiment no longer feeling stressed.

Discussion

The aim of the current research was to examine whether stress affects the ability to detect dishonesty of another person. Furthermore,

we explored whether it mattered how veracity is assessed. Specifically, participants were asked to detect veracity indirectly (i.e., is the target trustworthy?) as well as directly (i.e., is the target lying?). Overall, when participants gave their impression of the trustworthiness of the targets, they judged truth-tellers to be more trustworthy than liars. This ability to distinguish between liars and truth-tellers on indirect measures is in line with previous findings where the indirect question assessed the target's appearance (e.g., whether they have to think hard; Ulatowska, 2010, 2014; Vrij et al., 2001) and with previous findings where the indirect question assessed an intuitive response of the observer (van 't Veer et al., 2015; van 't Veer et al., 2014). Additionally, on direct measures, participants performed slightly above chance when they explicitly had to indicate whether the target was lying. This confirms previous findings that people are not very accurate in discriminating between liars and truth-tellers (Bond & DePaulo, 2006).

We found mixed evidence for an effect of stress. First, direct deception detection was not enhanced under stress. Second, we found partial evidence that indirect judgments were affected by stress. The overall analysis of indirect deception detection did not yield an interaction. However, specified comparisons did reveal that the ability to distinguish between liars and truth-tellers was aided under stress: In the stress condition, truth-tellers were judged to be more trustworthy than liars, whereas in the control condition trustworthiness judgments did not differentiate between truth-tellers and liars. These results provide tentative support for the idea that people are able to intuit that trust may be betrayed and that stressful circumstances may enhance this intuition about the trustworthiness of others. Taken together, when evaluating dishonesty under stressful circumstances, it seems best to rely on indirect judgments that are inherently more automatic rather than on directly assessed veracity judgments.

We tested the ability to detect trustworthiness from dynamic video material because of the assumption that the ability to judge others both on the basis of their stable features indicative of moral character and their demeanor is likely to be a product of natural selection. Humans have a strong tendency to cooperate with those who do also, and to punish those who violate moral norms (Fehr &

Gachter, 2002; Gintis, Henrich, Bowles, Boyd, & Fehr, 2008). During primate and human evolution, individuals who were able to assess the verbal and non-verbal behavior of those around them would have been better able to form reliable social relationships with trustworthy individuals. Accordingly, people readily judge good and bad intentions in others (Fikse, Cuddy, & Glick, 2007; Hamlin, Wynn, & Bloom, 2008; Winter & Uleman, 1984) and people are able to sensibly evaluate others while these others are making their decision or after a face-to-face interaction (DeSteno et al., 2012; Verplaetse et al., 2007). Combining these findings with findings in the deception detection literature, we found that indeed, trustworthiness judgments made on the basis of dynamic information were different when a target was lying compared with when he or she was telling the truth.

When a target lied, he or she was deemed less trustworthy compared with when he or she was honest. This is in line with previous findings that show that this ability to distinguish between liars and truth-tellers is present when judgments of liking are made but not when more deliberated explicit judgments of whether someone is lying are made, even in cases where these latter judgments are made on a continuous scale (van ’t Veer et al., 2014). The current results further suggest that this trustworthiness detection is automatically present: Inducing stress did not improve trustworthiness detection by a great margin even though the current manipulation is suggested to shift processing to a bottom up fashion. Together with other studies that likewise show distinguishability between honest and dishonest messages of the same target when affective evaluations are made (van ’t Veer et al., 2014, 2015), this suggests that indeed people have some sort of ‘gut feeling’ about the deceptiveness of their interaction partners.

Directions for future research

The current findings parallel other evidence that likewise points in the direction of automatic responses to untrustworthiness. For instance, specific neural responses to untrustworthy faces are present both when judging trustworthiness explicitly and when judging whether the target was a high school or university student (Winston et al., 2002). This suggests that neural activity indicative of

a ‘gut feeling’ is present irrespective of whether participants are explicitly asked to judge trustworthiness. In similar vein, Bonnefon et al. (2013) showed that people are able detect trustworthiness from a picture of a face, and that this ability was not affected by concurrent cognitive load. Interestingly, this ability was present when participants responded by making a trust decision in a trust game, yet there was no difference in explicit ratings of trustworthiness from the same faces. In other words, participants’ behavior towards the targets, not their judgments, reflected the ability to detect trustworthiness. This suggests that once explicit judgments have to be made from only the face, people do not have conscious access to the gut-level processes that produce a trust decision. Likewise, direct veracity judgments that ask participants to call someone a liar on the basis of dynamic information may be too explicit. However, automatically formed global impressions of the trustworthiness of a person who may very well be lying could tap into the underlying ability to detect trustworthiness. It is for future research to examine whether trustworthiness judgments made from dynamic information will likewise be robust to actual concurrent load and whether people’s behavioral choices towards dishonest individuals are advantageous.

The current data suggest that, especially given our sufficient sample size to detect a medium effect size with 98% power, it is likely that we are dealing with a smaller effect than expected. Therefore caution is warranted when drawing the conclusion that people are or are not able to detect liars, especially when taking into account that in real life situations there are an infinite number of other factors at play that may distract or overwrite relevant intuitions. The current results suggest that being under stress—a state that has been argued to hinder cognition—is not a factor that distracts from these intuitions. It is for future research to examine whether the small effects of first impressions can have long-term consequences that are of graver importance for the less trusted. Additionally, effects may be bigger in instances where participants are not explicitly asked for a judgment but are instead, for instance, asked to act towards the target (e.g., to cooperate with them or to trust them; cf. Bonnefon et al., 2013). An especially fruitful avenue for future research seems to be the consideration of moderators indicative of threat and challenge (e.g.,

Scheepers, de Wit, Ellemers, & Sassenberg, 2012) when participants are asked to detect deception under stress.

Conclusion

The present experiment provided tentative evidence for an enhanced ability to detect deception under stressful circumstances. With a direct veracity judgment, the ability to detect deception was not enhanced under stress. With an indirect veracity judgment, when under stress, trustworthiness judgments of targets that were telling the truth were higher than trustworthiness judgments of targets that were lying. Importantly, these findings not only suggests that people are able to detect trustworthiness from dynamic information about the target, they also highlight that the ability to indirectly detect deception is robust to stress and could even show enhancement under stressful conditions.

Chapter 5

Effortless warmth responses to honesty

This chapter describes a pilot study, a pre-registration, and a pre-registered experiment that were conducted to examine psycho-physiological responses to being lied to. Bridging research on social cognition and deception detection, we hypothesized that observing a liar compared to a truth-teller would decrease finger skin temperature of observers. Participants first watched targets while not forewarned that they would later be asked to judge (direct and indirect) veracity, and then watched other targets while forewarned about this. During both these phases finger skin temperature was measured. Findings pertaining to temperature partly confirmed our main hypothesis that temperature would decrease when participants observed dishonesty. Results confirmed that participants judge liars as less likeable and less trustworthy than truth-tellers—an indication of indirect deception detection. Effect sizes for trustworthiness and liking judgments were similar. Additionally, participants performed around chance level when directly judging whether the target person was lying. Limitations and directions for future work related to the existence of psychophysiological indicators of deception detection are discussed.

This chapter is based on: van ’t Veer, A. E., Stel, M., van Beest, I., & Gallucci, M. (2014). Registered report: Measuring unconscious deception detection by skin temperature. *Frontiers in Psychology*, *5*, 442.
And: van ’t Veer, A. E., Gallucci, M., Stel, M., & van Beest, I. (2015). Unconscious deception detection measured by finger skin temperature and indirect veracity judgments—results of a registered report. *Frontiers in Psychology, 6*, 672.

Chapter 5: Effortless warmth responses to honesty

Being able to detect deception of others—or at the very least knowing whom to trust—was most likely an indispensible advantage during human evolution. Indeed, there are many indications that judging (moral) character and forming impressions of the intentions of others is an elementary, innate ability (e.g., Fiske, Cuddy, & Glick 2007; Miller, 2007; Willis & Todorov, 2006). Nevertheless, a robust finding in the deception detection literature indicates that people are no better than chance at detecting a liar (Bond & DePaulo, 2006). This is the case, at least, when deception detection ability is assessed with veracity judgments that directly ask about the untruthfulness of a statement. At the same time, an increasing amount of evidence is emerging from the deception detection literature that suggests that people's judgments of liars and truth-tellers *do* sometimes differentiate between the two—especially when these judgments are assessed in an indirect way.

Building on evidence suggesting that people are able to differentiate between liars and truth-tellers when asked indirectly, we aim to add to this previous work by not only measuring direct and affective indirect veracity judgments, but also by exploring the possibility of a physiological marker (i.e., an unconscious indicator) of this indirect deception detection. In the current chapter we propose to measure skin temperature, as we believe that this physiological proxy of social interaction could be an important indicator of people's correct intuition towards liars.

Intuitive deception detection

As noted above, people are not very good at verbalizing whether another individual is lying or not. Indeed, people's direct veracity judgments rarely exceed what could be expected on the basis of chance (Bond & DePaulo, 2006). Yet when people's judgment of a liar is assessed in an indirect way, they do seem to be able to distinguish the liar from the truth-teller. Although this does not mean that people are aware that they are being lied to, it does mean that

compared to truth-tellers, people's impressions of, or feelings toward, liars are different. One telling piece of evidence for people's ability to indirectly detect deception is a study comparing direct ('Is the person lying?') to indirect ('Does the person have to think hard') judgments made by police officers (Vrij, Edward, & Bull, 2001). Results of this study indicate that the *indirect* judgments distinguished between liars and truth-tellers (i.e., the liars were judged to be thinking harder), whereas the *direct* judgments did not. A meta-analysis touching upon indirect deception detection also found that people report more confidence in their judgment after perceiving a truthful compared to a dishonest message (DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997), leading authors to conclude that this supported the idea that feelings of confidence—as indirect measures of deception detection—might differentiate truths from lies. Additionally, subjective impressions seem to distinguish liars from truth-tellers better than objective measures. In their meta-analysis, DePaulo et al. (2003) found that subjective measures of verbal immediacy (e.g., active vs. passive voice), eye contact, and facial pleasantness all discriminated between a liar and a truth teller, whereas the objective measurements of these features (e.g., the coding of their occurrences by independent researchers) did not. The most compelling evidence for people's ability to sense someone is lying comes from research comparing an intuitive to a more deliberative processing style. Albrechtsen, Meissner, and Susa (2009) found that intuitive judgments of deception were more accurate than deliberative judgments. On top of this, these authors found that automatic judgments made when conscious attention was directed at a concurrent task were more accurate than judgments made after conscious reasoning about one's deception judgment. These findings suggest that, on some level, people intuit that they are being lied to while they are forming an impression of a liar.

The fact that directly judging someone to be a liar is difficult is understandable considering that there is a lack of cues that people can use to reliably detect a liar (DePaulo et al., 2003). Yet even though cues might be weak, some evidence of their presence does exist. Liars are perceived as more tense and less forthcoming, they have less compelling stories, speak in a higher pitch, and make a more

negative impression—truth tellers, on the other hand, come across more direct, certain, and more personal (DePaulo et al., 2003). Although not always consciously aware of it, people are very good at picking up subtle cues from their social environment (Bargh & Chartrand, 1999). This is, for instance, supported by both research on mimicking suggesting that nonverbal behavior is regulated mostly outside of conscious awareness and that it has consequences at the behavioral level (Chartrand & Bargh, 1999; Stel, van Baaren, & Vonk, 2008), and research on emotional face-to-face communication (Dimberg, Thunberg, & Elmehed, 2000). Similarly, as we suggest here, people might thus unconsciously pick up on some of the less apparent cues given away by a liar.

Our reasoning is based on indications that forming impressions of the intentions of other people seems to be an automatic process, one that has been argued to be evolved in order to enhance chances of survival (Fiske, Cuddy, & Glick, 2007). More specifically, to the extent that forming alliances with trustworthy others benefits survival and reproduction, being able to detect trustworthiness in others has adaptive value. One major marker for trustworthiness is emotional expressivity, where emotional expressiveness is positively related to being judged as trustworthy (Boone & Buck, 2003). As liars may try to control their expressive behaviors (DePaulo et al., 2003), liars could generally be perceived as less trustworthy. People judge trustworthiness of others very rapidly (Willis & Todorov, 2006), and base their social decision-making on it (van 't Wout & Sanfey, 2008). People are also especially good at judging someone's warmth—an indication of the favorability of another person's intentions toward us—as compared to their competence (Fiske et al., 2007). In similar vein, people judge liars less likable and less trustworthy than truth-tellers, and tend to increase their own deceptive behavior towards a liar (Tyler, Feldman, & Reichert, 2006). It appears that people are wired to detect friendly intent or potential threats in others, and adjust their behavior towards them accordingly.

Seminal work has demonstrated that from early on in life, being able to know who to trust and forming emotional attachments is essential for development (Bowlby, 1969), and that physical contact is essential for survival and psychological wellbeing (Harlow, 1958).

Accordingly, it has been argued that the association between warmth and trust is strengthened during early development, as physical warmth usually co-occurs with care from trusted others (IJzerman & Koole, 2011). Recent research also suggests there is a relationship between perceiving a person as trustworthy and temperature perceptions. Szymkow, Chandler, IJzerman, Parzuchowski, and Wojciszke (2013) found focusing on traits unrelated to trustworthiness did not affect perceptions of ambient temperature, whereas focusing on traits relevant to trustworthiness (i.e., communion, warmth) did. This also led the authors to argue that perceptions of temperature—which could arguably be stemming from bodily temperature changes—can inform on the trustworthiness of others. The question we are concerned with here is whether forming an impression of an untrustworthy or trustworthy person influences actual physical temperature.

Physical and interpersonal warmth

There have been a number of studies linking skin temperature to interpersonal relations. For instance, social exclusion not only makes people feel bad but it also makes them feel colder (Zhong & Leonardelli, 2008) and this is reflected in actual skin temperature (IJzerman et al., 2012). Correspondingly, temporarily holding a warm object—such as a tea cup—can mend this negative affect (IJzerman et al., 2012) and positively influences judgments of interpersonal warmth (trust) and enhances positive behavior towards others (Williams & Bargh, 2008). Physical temperature has also been found to influence trust behavior in an economic trust game (Kang, Williams, Clark, Gray, & Bargh, 2011), and as mentioned above, focusing on a target person's psychological warmth increases estimates of ambient room temperature (Szymkow et al., 2013). These findings suggest a process of bodily temperature regulation during social interaction, wherein elements of the interaction influence the body and vice versa. Building on these ideas of the embodiment of social relationships, the question arises, then, whether unconsciously

picking up on untrustworthiness (i.e., another person lying) is also accompanied by temperature changes.

Finger skin temperature is an excellent way of assessing psychophysiological change and reflects sympathetic vasoconstriction—a known reaction to pain or mental and emotional stressors—with an average delay of about 17 seconds (Kistler, Mariauzouls, & von Berlepsch, 1998). Although in the case of thermoregulation a lot is still to be revealed about its causes and consequences, there are some notable findings. For instance, a decrease in skin temperature is usually associated with negative or stressful events, such as being asked threatening personal questions (Rimm-Kaufman & Kagan, 1996), anticipating and receiving electric shocks (Boudewyns, 1976), watching the shower murder scene of Alfred Hitchcock's movie 'Psycho', hearing the noise of a ruler slapping on a table without seeing it (Kistler et al., 1998) or being excluded (IJzerman et al., 2012). It is also found that the decrease in finger skin temperature that is observed during relatively stressful events can be alleviated by a subsequent relaxation phase (Boudewyns, 1976). Obviously, stressful experiences are not the only elicitor of changes in physiology, and with this work we aim to expand knowledge on the aforementioned relationship between the social environment and thermoregulation.

We suggest that to capture the full range of people's reactions to liars, the physiological reaction of the observer of a liar should also be taken into account. Whereas we propose to focus on the observer of a liar, to date, more is known about the physiology of liars themselves (cf. Podlesny & Raskin, 1977; Wang, Spezio, & Camerer, 2010). For instance, in interrogation settings, the polygraph is a well-studied instrument, but it is also far from perfect (see Lykken, 1998, for a critical review). More specific to thermoregulation, the stress in a sender of a deceptive message is found to manifests itself in blood flow to the face (specifically, the orbital muscle area) resulting in elevated temperature in this area (Tsiamyrtzis et al., 2006). However, to our knowledge, we are the first to put forth the argument that the physiology—and in particular the thermoregulation—of the receiver of a deceptive message should be investigated to acquire knowledge of the underlying mechanisms of social interactions.

The proposed research

In the proposed research, we aim to explore whether skin temperature is influenced by observing liars and truth-tellers and whether temperature relates to self-reported judgments of these liars and truth-tellers. Previous work has provided two notions that are of interest to the current thesis: Physiological markers can precede explicit knowledge (Bechara, Damasio, Tranel, & Damasio, 1997), and, these markers influence decision-making (Bechara & Damasio, 2005, but see Dunn, Dalgleish, & Lawrence, 2006, for a critical evaluation). In the case of deception detection, a physiological marker may precede explicit judgment of a liar. To our knowledge, no attempt to find such a physiological marker of deception detection exists to date. Yet if this process by which physiological markers influence people's deception judgment could somehow aid people's conscious assessment of a liar, it does not seem to do so unless they are induced to rely on their intuition (Albrechtsen et al., 2009). For this reason, we will ask participants to rate both their liking and trustworthiness of liars and truth-tellers, as *indirect* measures, and their *direct* veracity judgment. We will measure this together with finger skin temperature in two distinct situations: First when participants are *not* aware they might be lied to (i.e., they are not forewarned), and subsequently, when they *are* aware of this possibility (i.e., they are forewarned). We thereby examine whether forming an impression of a liar compared to a truth-teller, even not having a conscious goal of detecting deception, is accompanied by physiological states that can be differentiated by measuring finger temperature.

Below we first describe an exploratory pilot study (Study 5.1[6]) that was conducted to familiarize ourselves with methods of investigating the proposed association between finger skin temperature and deception detection. We then describe how and why this pilot study can be improved, and then describe the pre-registered experiment we conducted while incorporating these improvements. This pre-registered experiment was awarded *In Principle Acceptance*

[6] Data and accompanying syntax can be found via the link: http://opensciencefframework.org/project/bgrVB/node/YZjUB/files

after having gone through peer review. In the appendix to this chapter we provide further details of the pre-registration itself. This description can also be found in a methods paper holding the pre-registration, and includes the hypotheses, analysis plan, and proposed sample (see van 't Veer et al., 2014).

Study 5.1 (pilot study)

In this study there were 132 participants of which 18.2 % was excluded according to the same exclusion criteria that are described for the pre-registered experiment below (1 for failure to save the data, 21 for recognizing a target person, 2 for participating before), leaving 108 participants (M_{age} = 20.62, SD_{age} = 2.49, 64.8 % female).

In this pilot study, participants first saw a five-minute long neutral nature movie and then saw a total of four videos of three minutes each, in which a target person either gave a truthful or an untruthful impression of themselves (below we refer to this as the target person's veracity). While participants were watching these videos, we measured their finger temperature. The four videos were structured in two blocks of two videos each; in the first block participants randomly saw one truth-teller and one liar, and in the second block they again randomly saw one truth-teller and one liar. After the first block of videos participants answered two veracity questions for both videos in the first block, and they again answered these same questions after the second block. This allowed us to ensure that for the first two videos the participants were not aware of the fact they might be lied to, but for the last two videos they were (in the pilot study we refer to this factor as awareness). For each target person, the participants were asked to indicate how much they liked this person, and whether they thought the target person was telling the truth (both on 7-point scales).[7]

[7] Because the procedure of Study 5.1 and Study 5.2 are similar (with the exceptions that we did not measure trustworthiness in Study 5.1, that the 'warm up' time was shorter in Study 5.1, and that awareness was manipulated less strongly in Study 5.1), we refer to the description of the pre-

Results

Linear mixed models were performed on the temperature data. In our full model, regarding the fixed effects, there was a three-way interaction between veracity, awareness and time, b = .0002, $F(1,73218.7) = 6.69$, p = .010. We also found an average (across time) interaction between veracity and time, b = .0007, $F(1,73218.7)$ = 387.14, $p < .001$, an average (across time) interaction between awareness and time b = -.001, $F(1,73218.7) = 993.88$, $p < .001$, and a quadratic effect of time, b = .000008, $F(1, 107.430) = 14.04$. Additionally, there was a significant main effect of awareness, b = -.107, $F(1, 108.105) = 6.78$, p = .011. There were no significant main effects of veracity, order, and time. Order did not interact with the other experimental factors, and there was no interaction between veracity and awareness, all ps > .175.

These results suggest that veracity predicted temperature differently in the unaware vs. the aware phase, and that this effect was changing over time. To understand the interactions, we plotted the average temperature over time as a function of veracity, broken down by awareness levels (see Figure 5.1).

From Figure 5.1 it becomes apparent that in the first phase (i.e., in the first block of videos) participants were warming up over time while watching both a video of a liar or a truth-teller. Interestingly and surprisingly, in the aware phase (i.e., the second block of videos) finger temperature dropped when watching a video of a truth-teller, more so than when watching a liar.

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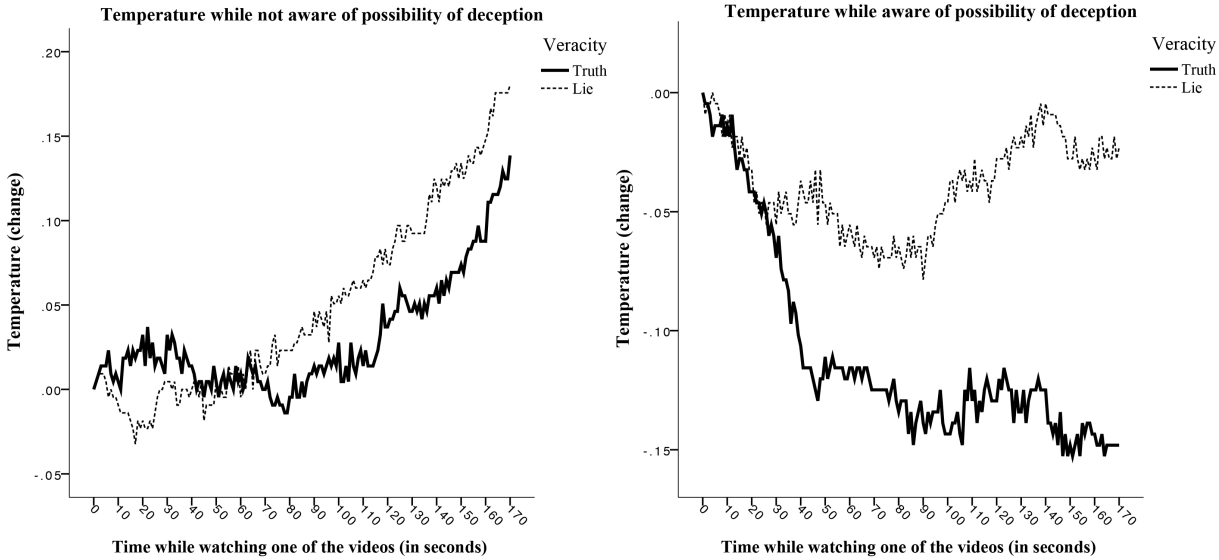
registered study (Study 5.2) for a detailed account of the procedure and materials used.

A) Observed temperature



B) Estimated temperature

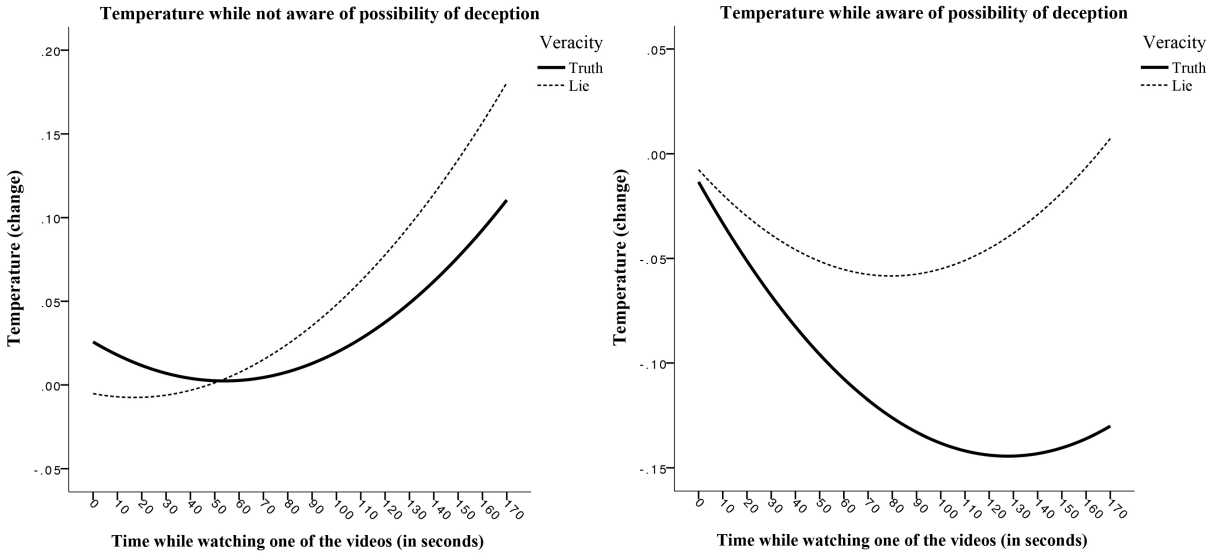


Figure 5.1. Average observed (A) and estimated (B) temperature change over time in Study 5.1 as a function of type of video, broken down by awareness levels.

In this pilot study, participants' liking of the target person on the video was assessed (the *indirect* judgment), and whether they felt that the target person was telling the truth (the *direct* judgment). Liking for liars was lower (M = 4.57, SD = 1.00) than liking for truth-tellers (M = 5.15, SD = .80), $t(107) = -4.873$, $p < .001$, 95% CI [-.81, -.34], Hedges's g_{av} = 0.64. The CL effect size indicates that after controlling for individual differences, the likelihood that a participant scores a truth-teller higher on liking than a liar is 68%. The direct deception judgment, however, was not significantly different for liars (M = 5.10, SD = 1.14) than for truth-tellers (M = 5.10, SD = 1.14), $t(107) < 1$, $p = 1$. This indicates that even though participants disliked liars more than truth-tellers, they did not explicitly judge them as being more deceptive than the truth-tellers. We conclude from this that people are indeed able to intuit that something about a liar is "off" and sense a subtle difference between liars and truth-tellers when their judgment is assessed in an indirect way.

Correlations were run between temperature and liking and temperature and veracity judgment for liars and truth-tellers. Out of eight correlations run (temperature during a first block-truth with both the direct and indirect judgment of the truthful person, temperature during a first block-lie with both the direct and indirect judgment of the liar, and the same four correlations for the second block) there were two significant correlations, both in the second block: the higher a participant's temperature while watching a truth-teller, the more this participant thought the target person was telling the truth, $r(106) = .26$, $p < .01$, and the more this participant thought the target person was likable, $r(106) = .19$, $p < .05$.

To summarize, in the pilot study we found that participants' finger temperature increased while watching a liar or a truth-teller in the first block of videos (i.e., when participants were not aware of the possibility of being lied to), but in the second block of videos (i.e., when participants were aware of the possibility of being lied to), we found participants' finger temperature dropped while watching a liar or a truth-teller, but more so for the truth-tellers. This interaction of veracity with the different experimental phases is interesting in itself, as it shows that our design and stimuli do indeed elicit temperature changes in our participants.

Improvements to Study 5.1

Findings of Study 5.1 were not entirely consistent with the reasoning outlined in the introduction, and therefore we proposed and pre-registered an additional study to confirm or disconfirm our hypothesis that participants' finger temperature will lower when perceiving a liar. In Study 5.1, participants' temperature was still increasing with time during the first videos a participant encountered (irrespective of whether they were watching a truth or a lie). The neutral movie in the pilot study might thus have been too short for participants to reach a stable temperature. We feel we can improve on the study's procedure by allowing a longer 'warm up time'. In other words, for the proposed study, we will present the participant with a longer neutral movie before the targets are presented. Results of Study 5.1 also indicate that participants could differentiate between liars and truth-tellers on the indirect veracity judgment (i.e., liking), but not on the direct veracity judgment. In the pre-registered study, we aimed to replicate this finding to assess the robustness of this effect of indirect deception detection, and we add to it by now also incorporating a measure of trustworthiness of the target person. These direct and indirect veracity judgments also allow an attempt to replicate the finding in Study 5.1 that higher finger skin temperatures correlate with the judgment that someone is telling the truth and with liking that person. In our opinion, these initial results provide a tentative indication of a physiological marker intertwined with a mechanism designed for (unconscious) deception detection.

Study 5.2

Pre-registered Hypotheses

There were several hypotheses put forward during the pre-registration of Study 5.2. To facilitate and clarify the distinction between our confirmatory and exploratory analyses, we restate the hypotheses here. Our main hypothesis was that finger skin temperature would decrease during the watching of a 3-min video clip of a liar (H1). We further hypothesized that participants would judge truth-tellers more trustworthy and likeable than liars (the *indirect*

veracity judgments; H2a), with the additional hypothesis that this effect would be bigger for the trustworthiness judgment than for the liking judgment, because trustworthiness judgments are suggested to be more automatic and intuitive and would therefore tap into the covert differences between liars and truth-tellers better (H2b). Next to this, we hypothesized that when asked to judge whether a target person is lying, participants' judgment would not differentiate between liars and truth-tellers better than chance (the *direct* veracity judgment; H3). Finally, we hypothesized that the indirect veracity judgments, namely the liking and trustworthiness for the target person, would be positively related to finger skin temperature, whereas the direct veracity judgment would not be (H4).

We also again included two distinct phases in our experiment. As in Study 5.1, first participants were *not* forewarned they might be lied to, and subsequently, they *were* forewarned of this possibility. This allowed us to explore whether the hypothesized effects interact with the level of suspicion participants may have. People have their own ideas about what a liar could look like, yet these beliefs about cues are often incorrect (Vrij & Semin, 1996). Having a goal to detect deception could therefore arguably make participants look for these cues more. Additionally, looking for specific cues (e.g., cues that indicate untrustworthiness) may prompt participants to process information more systematically. On the one hand, it could be expected that increased suspicion in the forewarned phase may result in an overall tendency to trust less, without making veracity judgments more accurate (De Neys, Hopfensitz, & Bonnefon, 2013). On the other hand, being forewarned could benefit the impressions that are formed of targets. Signs of untrustworthiness may more readily be perceived as such due to high accessibility. We therefore tested whether skin temperature, as well as both the direct and the indirect veracity judgment, were differently affected in these two phases.

Exploratory Research Questions

In addition to the pre-registered hypotheses and exploratory examination mentioned above, we explored our data on the basis of two considerations that occurred after the results were in. First of all,

we tested whether on the direct veracity judgment participants were better than chance at detecting deception while controlling for the indirect judgments. We did this to understand the interdependence of the direct and indirect veracity judgments: Although trustworthiness and likeability judgments were counterbalanced, the direct veracity judgment always came after these two indirect judgments. Secondly, we also explored whether participants' tendency to judge a target as a truth-teller (truth-bias) was lower in the forewarned phase than in the not forewarned phase. Truth-bias has been argued to be especially prominent during automatic compared to systematic processing (Masip, Garrido, & Herrero, 2009). Therefore, if truth bias were lessened in the forewarned phase this could be an indication, although not conclusively so, of more systematic processing.

Method[8]

Participants. In accordance with the Registered Report, data was collected over a period of three weeks. Participants received either course credit or €8. This resulted in a total *N* of 191, exceeding our minimal planned sample size of 120 due to running full weeks. We excluded 36 (18.85%) of the participants on the basis of one or more of our predefined exclusion criteria; 2 participants for knowing that the experiment was about measuring temperature, 28 for being acquainted with one or more of the target people on the videos, 10 for technical failure of the temperature measurement, and 1 person for smoking more than 20 cigarettes a day. We did not disregard any data points on the basis of our predefined temperature cut-off: participants' finger skin temperature did not fall below 18 °C or above 37 °C. Our final sample therefore consisted of 155 participants, 60.65 % female, M_{age} = 21.35, SD_{age} = 3.78, age range: 18-53 years. Participants completed an hour of experiments of which this study was the last half hour, allowing skin temperature to reach a stable level before the experiment began. We did not deviate from the registered minimum sample size, data exclusions, manipulations, or measures in the study except for one instance that we outline in footnote 11.

[8] For a description of adequate detail to allow close replication is provided in the pre-registration of this experiment (see Appendix for Chapter 5).

Design and Procedure. Participants' finger skin temperature was measured with an iButton (see Pouw, Flore, & IJzerman, 2012 for software instructions) during the entire experiment. The first experimental factor, veracity of the target person, was manipulated by showing participants a total of four videos containing either a truth-teller or a liar. The second experimental factor, being forewarned or not, was manipulated by not informing participants that the goal of watching the videos was to detect deception for the first two videos (not forewarned phase). For the last two videos, participants were informed of this (forewarned phase)[9].

All participants first watched a nature documentary of 8 minutes, which allowed the iButton to reach a stable finger temperature. Participants then watched two videos of 3 minutes that randomly contained a target person being truthful or untruthful about their identity (not forewarned phase). Next, participants completed our three main dependent variables: For the first and second target person separately, participants were asked to indicate how much they liked this person and how trustworthy they thought this person was (the indirect veracity judgments; both on 7-point scales, order counterbalanced between participants), followed by whether they thought the target person was telling the truth (the direct veracity judgment; forced choice between *yes* or *no*).

We refer to the next phase as the forewarned phase. Due to completing the three main dependent variables participants were now warned about the type of questions they would be asked. From these questions, in turn, they could infer that there was a possibility that the target person would lie. We further stressed the purpose of watching the next videos by telling participants they would get the same questions for these videos. Additionally, all three questions were repeated to help remind them. Participants then proceeded to watch the last two videos that randomly contained a truth-teller or a liar, and completed the three main dependent variables for this third and fourth target person. At the end of the experiment, participants indicated their age, gender, smoking behavior, acquaintance with any of the

[9] In Study 5.1 these two phases were termed 'unaware' and 'aware'.

people presented in the videos, dominant hand, and their thoughts on what the experiment was about.

Results

All data pre-processing steps (as described in the pre-registration) are available from the first author on request. De-identified data, syntax, R scripts and supplemental material are available online, see: https://osf.io/j8w4i/?view_only=2ddebadf2448455ba4f8feae661d832d

Confirmatory Analyses

Temperature trajectories. The first hypothesis stated that finger skin temperature would decrease while observing a liar (H1). Figure 5.2 shows the average temperature trajectories over time for both the not forewarned and forewarned phase. To test the first hypothesis, a model was run in which all factors were modeled as both fixed and random effects in order to estimate the main effect of veracity, the main effect of gender, the main effect of being forewarned, the main effect of order, their interactions, and the interaction of the experimental factors with time. As described in the pre-registration, the interaction of the experimental factors veracity, being forewarned and time informs on whether temperature trajectories change depending on the target person's veracity and on whether participants were forewarned of the fact that this is a situation in which they have to detect deception. Therefore, the most important effect of the complete model is the interaction effect of the experimental factors and their interaction with time, because the expected change in temperature due to the experimental factors should unfold over time[10].

[10] As planned, we computed participants' temperature minus their temperature at the beginning of the video, and because we should allow some time for any influence of our manipulations to take effect, we centered time on the last second of the video. This deviates from our original plan to center time on 85 seconds, however it does not influence the interactions between time, veracity, and being forewarned that are of interest. This will produce an

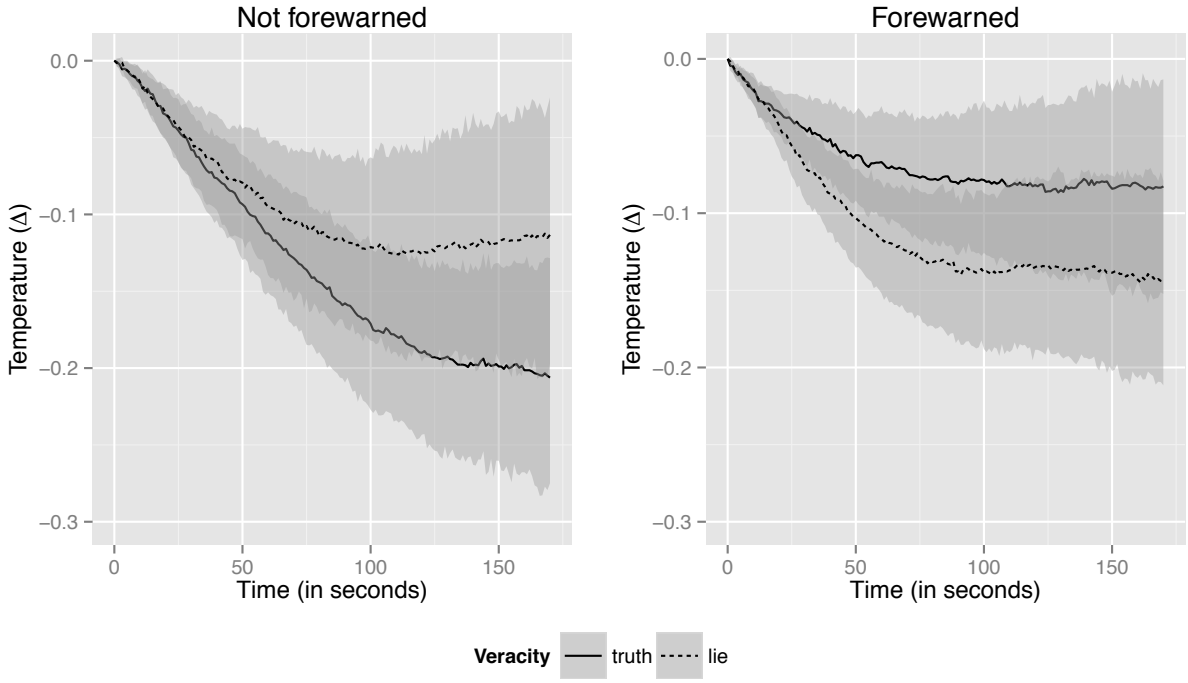


Figure 5.2. Average observed temperature change (with confidence interval) over time as a function of veracity of the target person (truth or lie), broken down by phase: While not forewarned of the possibility of deception (left) and while forewarned of the possibility of deception (right).

There was a main effect of time (b = .0006, F[1, 153.026] = 5.251, p = .023) and a quadratic effect of time (b = .000007, F[1, 154.432] = 46.779, p < .001), indicating that participants' finger skin temperature dropped during a video and climbed a little towards the end of the video. To grasp the meaning of the size of these effects of time, one could consider that on average our participants' finger skin temperature was getting one tenth of a degree colder in 3 minutes. There was also a main effect of gender (b = -.146, F[1, 154.140] = 6.829, p = .010) indicating females were relatively colder than males, but there was no interaction of gender with the other experimental factors (all ps > .341). Neither veracity nor being forewarned had a main effect (ps .866 and .509, respectively), and time did not interact

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estimate (b) of the influence of observing a truth-teller or a liar for approximately three minutes on participants' finger skin temperature.

significantly with veracity or being forewarned (p = .598 and .122, respectively). The order of seeing a truth-teller or a liar first did not have an effect on participants' temperature, nor did the order of judging trustworthiness or liking first (p = .800 and p = .848, respectively). Neither of these orders interacted with veracity or being forewarned (p = .626 and p = .494, respectively).[11,12,13]

Importantly, there was a marginally significant three-way interaction between veracity, being forewarned, and time, b = -.001, F(1, 154.001) = 3.598, p = .060, and, also a marginally significant interaction between veracity and being forewarned, b = -.165, F(1, 153.534) = 3.461, p = .065 (see Figure 5.2). Together, these interactions suggests that when participants were not forewarned, their finger skin temperature lowered more when they were watching a

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[11] In the pre-registration we stated that participants who had "prior experience with the temperature measure (and its debriefing) will be offered participation in another study and will be refused participation in the current study on theoretical grounds, as people may be able to consciously control their own finger temperature (Keefe, 1978)". Two participants did participate but stated in their comments they were aware that temperature was measured, and thus we saw fit to exclude them. Not excluding these two participants does not change the overall results: The interaction between veracity and being forewarned is still marginally significant, b = -.173, F(1, 155.599) = 3.758, p = .054 and so is the interaction between veracity, being forewarned, and time, b = -.001, F(1, 156.000) = 3.780, p = .054.

[12] We excluded one participant who indicated to smoke more than 20 cigarettes a day (as our pre-defined exclusion criteria required). Including this participant did not change any of the interpretations of the results, both the interaction between veracity and being forewarned and the interaction between veracity, being forewarned, and time were marginally significant (b = -.166, F(1,154.453) = 3.552, p =.061, and b < .001, F(1, 155.000) = 3.655, p = .058, respectively).

[13] As was specified in the pre-registration, we also ran our full model while excluding participants who did not reach 30 °C during the neutral nature movie. This left a total of 108 participants (about two thirds of our total sample; M_{age} = 21.49, SD_{age} = 4.25, 53.70 % female). Excluding these participants did not change the estimate of the veracity × being forewarned interaction, however, the effect did become non significant: b = -.168, F(1,107.780) = 2.259, p = .136.

truth-teller compared to when they were watching a liar. Yet when participants were forewarned, their finger skin temperature lowered more when they were watching a liar compared to when they were watching a truth-teller. At the end of the videos, for not forewarned participants, watching a truth-teller meant a finger temperature .101 degrees colder than when watching a liar, whereas when participants were forewarned, watching a truth-teller meant a finger temperature .077 degrees warmer than when watching a liar. In other words, when watching truth-tellers, without consciously knowing what they were looking for, our participants' temperature lowered more than when participants did know what they were looking for. When watching liars, however, temperature lowered no matter whether participants were forewarned or not.

From the marginally significant three-way interaction, we can tentatively conclude that our prediction that finger skin temperature would decrease while participants watch a liar (H1) is supported by the data. However, only for the phase in which participants were forewarned that they could be lied to was this decrease more pronounced than the decrease we observed when participants were watching truth-tellers. Moreover, there was significant variation at the participant level, meaning that the effect of observing a liar or a truth-teller on skin temperature varied from one participant to another. We should therefore not exclude the possibility that there is an unknown individual difference characteristic that moderates the relationship between veracity and skin temperature (e.g., Whitsett & Shoda, 2014).

Indirect veracity judgments. Figure 5.3 depicts the means and standard errors of the indirect veracity judgments (trustworthiness and liking). We ran two separate models to test Hypothesis 2a; the first to assess whether liars were liked less than truth-tellers, the second to assess whether liars were rated lower on trustworthiness than truth-tellers.

The first linear mixed model with liking as the dependent variable and veracity, being forewarned, and order as predictors revealed a main effect of veracity, b = -.364, $F(1, 461.532) = 13.735$, $p < .001$, meaning that on average liars were liked less (M = 4.706, SE = 0.79) than truth-tellers (M = 5.071, SE = 0.79). There was also a

main effect of being forewarned, b = -.247, F(1, 462.203) = 6.287, p = .013, meaning that when participants were forewarned, they judged the target person less likeable. There was no interaction between veracity and being forewarned (p = .109), and no effect of order of seeing a truth-teller or a liar first (p = .717). The order of first judging liking of the target person and then judging the trustworthiness of the target person, or vice versa, did have an effect, b = -.307, F(1, 153.792) = 6.012, p = .015, such that if a participant first judged liking, their liking judgment was higher than if a participant first judged trustworthiness and then liking. Regarding the random intercepts, we found a non-zero variance (σ = .226, Wald Z = 3.102, p = .002), implying that participants have different average liking ratings.

The second linear mixed model with trustworthiness as the dependent variable and veracity, being forewarned, and order as predictors revealed an average effect of veracity, b = -.348, F(1, 461.656) = 11.843, p < .001, meaning that on average liars were deemed less trustworthy (M = 4.616, SE = 0.079) than truth-tellers (M = 4.965, SE = 0.079). There was also a main effect of being forewarned, b = -.347, F(1, 462.340) = 11.742, p < .001, meaning that when participants were forewarned, they judged the target person less trustworthy. There was a marginally significant interaction between veracity and being forewarned, b = -.335, F(1, 461.656) = 2.746, p = .098, suggesting that the difference on the trustworthiness judgment between liars and truth-tellers became bigger in the forewarned phase. Both the order of seeing a truth-teller or a liar first and the order of the indirect veracity judgments were not significant predictors in this model (p = .783 and .217, respectively). Regarding the random intercepts, we found a non-zero variance (σ = .180, Wald Z = 2.546, p = .011).

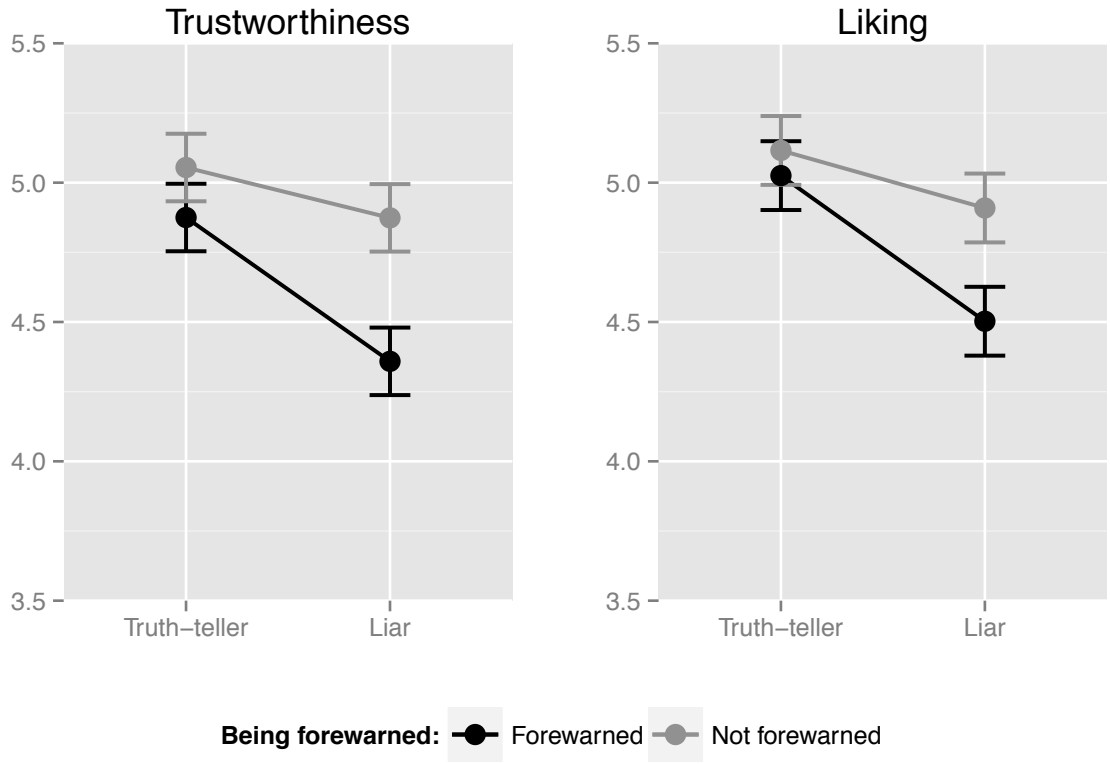

Figure 5.3. Means and standard errors of the indirect veracity judgments (trustworthiness and liking) for truth-tellers and liars, by phase (not forewarned and forewarned).

Taken together, the results of the indirect veracity judgments suggest that liars were liked and trusted less than truth-tellers. It also seems to be the case that being forewarned of the possibility of deceit made participants more distrusting overall, and especially so for liars. This indicates that if participants are alerted to the fact that they can be deceived, this helps them form better impressions of the target person's sincerity.

Hypothesis H2b stated that the effect of rating truth-tellers more positive than liars on the indirect veracity measures would be bigger for trustworthiness, as trustworthiness judgments are suggested to be automatic and intuitive and could therefore better distinguish the subtle differences between truth-tellers and liars. We tested whether the effect size of veracity on the trustworthiness judgment was higher than the effect size of veracity on the liking judgment. To obtain this test we estimated a mixed model with both trust and liking judgments

combined as a single dependent variable, veracity as independent variable, and with appropriate dummies indicating whether the scores refer to trustworthiness or liking. The interaction between the veracity term and the dummy provides the required test. This technique, one of the different ways to estimate a seemingly unrelated equation model, is largely inspired by random coefficients mediational models (Bauer, Preacher, & Gil, 2006; MacCallum, Kim, Malarkey, & Kiecolt-Glaser, 1997). We found no difference between effect sizes, coefficients difference = 0.019, $t(1073.8) = 0.130$, $p = .896$[14].

Direct veracity judgment. We estimated a mixed logistic model with participants' accuracy on the direct veracity judgment ("Is this person telling the truth, yes or no?"), with veracity, being forewarned, and order as predictors. Because the mixed model did not converge, the logistic regression parameters and the associated inferential tests were obtained with GEE methodology (Zeger, Liang, & Albert, 1988). An exchangeable working correlation matrix was used to model the dependency of observations. Results showed a main effect of veracity, $\chi^2(1) = 99.375$, $p < .001$, such that the probability of a correct response was higher when participants had been watching a truth-teller compared to a liar. There was no main effect of being forewarned $\chi^2(1) = 1.211$, $p = .270$, and being forewarned and veracity did not interact, $\chi^2(1) = 0.40$, $p = .841$. There was no effect of order ($p = .998$).

These results indicate that although participants were more accurate in detecting truth-tellers—a finding probably due to truth-bias (see also under exploratory analyses)—being forewarned or not did not significantly affect the ability to correctly detect liars and truth-tellers. Despite of this, there is value in examining whether for the different phases the probability of correctly detecting deception is higher than chance (H3). To test the accuracy of participants direct veracity judgments against chance in the two phases, we ran the same model as described above, with now only being forewarned as the

[14] We also explored the relationship between liking and trustworthiness judgments by using a mixed model with random intercepts after standardizing these variables, and found that liking and trustworthiness judgments were highly correlated (.670).

independent variable. In the not forewarned phase, participants were correct 52.92 % of the time, which did not differ from chance, $\chi^2(1) = .725$, $p = .395$, Wald 95% CI [.47, .58]. In the forewarned phase, participants were correct 57.42% of the time, which was significantly different from chance, $\chi^2(1) = 9.704$, $p = .002$, Wald 95% CI [.53, .63]. We further examined whether this higher accuracy rate in the forewarned phase could be explained by the indirect veracity judgments that were assessed right before it. We did this because the results also indicated that the indirect veracity judgments were affected by being forewarned. We report on this analysis under exploratory analyses.

Relationship between temperature and the veracity judgments. To assess whether participants' temperature at the end of the videos is predictive of their indirect and direct veracity judgments we ran separate models with temperature as the independent and liking, trustworthiness, accuracy of participants answer on the direct veracity judgment, and the answer of the direct veracity judgment as dependent variables. We did not find a relationship between temperature and any of these self-report measures. Temperature was not predictive of liking, $F(1,610.689) = 1.661$, $p = .198$, and it did not interact with the experimental factors to predict liking, all ps > .137. Temperature was also not predictive of the trustworthiness judgment, $F(1, 609.964) = 2.358$, $p = .125$. The interaction of being forewarned and temperature on trustworthiness was marginally significant ($p = .085$), however, interactions of veracity with temperature as well as the interaction of veracity with being forewarned and temperature were not significant (all ps >.633). For the direct veracity judgment, temperature did not predict whether the direct veracity judgment was correct, $\chi^2(1) = .009$, $p = .923$, nor did it predict whether participants said yes or no to the question whether the target person was telling the truth, $\chi^2(1) = .757$, $p = .384$.

Exploratory Analyses

Detection accuracy when controlling for indirect judgments. As is described above, we found participants' accuracy in detecting deception in the forewarned phase to be significantly higher than can be expected by chance. We also found an effect of being

forewarned on the trustworthiness judgment, such that in the forewarned phase, participants were more likely to judge a liar as less trustworthy. It could be the case, therefore, that because the indirect veracity judgments (i.e., liking and trustworthiness) were judged before the direct veracity judgment, participants accuracy on the direct veracity judgments was enhanced due to an enhanced performance on the indirect measures. To examine this possibility, we ran the model assessing whether accuracy at detecting deception was better than chance again, this time controlling for the indirect veracity judgments. Comparable as to when not controlling for these judgments, participants' deception detection accuracy was not significantly different from chance in the not forewarned phase $\chi^2(1) = .576$, $p = .448$, Wald 95% CI [.34, .71]. However, as a result of controlling for these judgments, in the forewarned phase, participants' accuracy was no longer significantly different from chance either, $\chi^2(1) = 1.982$, $p = .159$, Wald 95% CI [.39, .75]. This could imply a reliance of the direct veracity judgment on the indirect measures, although we are hesitant to make any firm conclusions on the basis of these results.

Truth bias. The finding that in the forewarned phase participants seemed to be better able to distinguish between liars and truth-tellers on both the indirect as well as the direct veracity judgment could be a side effect of an overall change in the tendency to judge messages as true. Our manipulation of being forewarned could have made participants more suspicious overall, leading them to judge a lower proportion of messages as truths. To test whether this was the case, we ran a GEE with the tendency to judge a message as the truth as the dependent variable and being forewarned and veracity as the independent variables. Although the tendency to make truth judgments was higher when actually watching a truth-teller compared to a liar, $\chi^2(1) = 7.962$, $p < .01$, the tendency to make truth judgments did not differ between the different phases, $\chi^2(1) = .612$, $p = .434$. Participants thus did not differ in their amount of truth judgments when watching truths in the not forewarned phase (proportion = .733) and the forewarned phase (proportion = .781), and they did not differ in their amount of truth judgments when watching lies in the not forewarned phase (proportion = .675) and the forewarned phase (proportion = .632).

General discussion

In the current chapter we explored people's automatic evaluative and physiological responses to observing a deceiver, as well as their more conscious direct evaluation of a target person's veracity. We did so in two distinct phases: First while participants were not forewarned of what the goal of observing another person was, and second while participants were forewarned that the goal was to form an impression of this other person's likeability, trustworthiness, and their veracity. We chose to measure participants' finger skin temperature because of the suggested embodied function of warmth in interpersonal relationships. The observed patterns of temperature change over time only partly confirmed our main hypothesis (H1), and the current findings pertaining to this hypothesis are therefore inconclusive. We found that finger skin temperature consistently decreased while observing a liar. When participants were observing a truth-teller, however, their finger skin temperature decreased more than it did for liars in the phase where participants did not have the goal to detect deception. In contrast, participant's finger skin temperature stayed higher when observing a truth-teller compared to a liar when participants did have the goal to detect deception. This latter pattern is consistent with the direction of our predictions based on the relationship between warmth and positive person impressions; however, it failed to achieve significance by conventional standards.

As for the judgments of trustworthiness and likeability—the so-called indirect veracity judgments—we found that across both phases, liars were consistently judged less trustworthy and less likeable than truth-tellers. This is in accordance with our hypothesis (H2a) which was based on earlier findings in the literature indicating that subjective, indirect, and intuitive judgments can contrast liars from truth-tellers (DePaulo et al., 2003; Vrij et al., 2001; Albrechtsen et al., 2009) and this finding replicates the findings of Study 5.1. In addition, results indicated that in the forewarned phase participants were more inhibited in their liking and trusting overall. Irrespective of this, trustworthiness and liking judgments were lower for liars than for truth-tellers in both phases. It thus seems that intuitive judgments are

reliable guides when forming impressions of the intentions of others no matter whether people are forewarned or not.

We did not observe a difference between the magnitude of the effect of the likeability judgment and the trustworthiness judgment. This fails to support our hypothesis that trustworthiness judgments would differentiate between liars and truth-tellers better than likeability judgments because of the relative automaticity that has been argued to underlie trustworthiness impression formation (H2b). In the current research the order of these two indirect veracity judgments was counterbalanced. For the likeability judgment we found the order of the questions to influence the judgments themselves: The target person was judged less likeable if trustworthiness was assessed first. These judgments were also highly correlated, suggesting that we cannot draw far-reaching conclusions from the fact that we found similar magnitudes of effects. Future research may test the difference in strength of these judgments in a between participants design rather than a within design.

For people's ability to accurately indicate whether someone was lying, we predicted that this direct veracity judgment would not detect deception much better than chance (H3), as the meta-analysis by Bond and DePaulo (2006) would suggest. We indeed found participants to be accurate about 53% of the time in the not forewarned phase, a performance that was not different from chance. However, when participants were alerted to the possibility of deceit and had the goal to detect deception, their accuracy rose to 57%. This percentage was significantly different from chance, although not as substantial as to suggest our participants were able to catch liars with a high success rate. It seems that, at least in the case where participants are searching for indications of ill intend, they had a slightly higher chance of correctly detecting a liar. This can be the case, for instance, because of a reduced truth-bias under conditions where people are more suspicious, or, as our exploratory analyses suggest, because intuitive impressions of others are aided by being a bit more on guard. A combination of these two processes could also be at play: Adjustment of the automatic tendency to judge most people to be evidently honest for the perception of ill-intent could require motivational resources (i.e., the goal to detect deception) as well as

indications from indirectly formed impressions. Future research could examine whether it best to be on guard while relying on intuition at the same time. We suggest that it is likely that this is what happens when affective judgments are made in a context in which deception is more salient.

Taken together, our participants' accuracy in correctly indicating whether they were being lied to was around chance level, and their impressions of liars' likeability and trustworthiness were likely to be more negative than their impressions of truth-tellers. Although comparing participants' accuracy on the direct judgment to the indirect judgments is not a fair comparison in this case, in Study 5.1 we assessed both types of judgments on a continuous scale, allowing for a better comparison. Results of Study 5.1 indicated very clearly that participants did not explicitly judge liars to be more deceptive than truth-tellers. In contrast to this, the indirect judgment that assessed to what extent a target person was likeable was significantly lower for liars compared to truth-tellers. Similar evidence for the superior accuracy of indirect questions has been found by others, for instance when using the question how hard a target person was thinking compared to the question whether the target person was lying (Ulatowska, 2014). Our results further imply that one and the same person is judged more negatively when he or she is lying compared to when telling the truth, even though this person has a good chance of ostensibly getting away with giving off a false impression.

With regard to the relationship between our self-report measures and skin temperature (H4), we found no meaningful correlations in Study 5.2. This can be contrasted with the results of Study 5.1, where we did observe a positive correlation between (a) temperature and liking the target person and (b) temperature and judging the target person to be telling the truth. This discrepancy calls for further exploration of the functioning of thermoregulation in response to real life social interactions and the possible interplay of physiological and psychological processes during deception detection.

As our main findings pertaining to the temperature measure reached marginal significance, we are hesitant to draw firm conclusions, and suggest future explorations in this area to consider an

even bigger sample size. Currently, we found an initial tentative trace of the supposition that observing a deceiver can influence the physiology of the observer. More specifically, our findings hint at a thermoregulatory mechanism that responds to the veracity of an impression another person is trying to convey.

Being Forewarned of The Possibility of Deceit

There are several possible explanations for why being forewarned or not would lead to different processes and outcomes. Below we discuss these explanations and relate them to our findings for the direct and indirect veracity judgments and the physiological changes. Our data suggest liars have more chance of getting caught when their observer is alerted to the possibility of deceit. This indicates that detection—and possibly the ability to process the rich variety of information that is sent by the target person—is aided by having a detection goal while decoding a message. It has been previously argued that having correct beliefs about what cues give a liar away benefits the observer only when such beliefs are activated while making the judgment: People have been found to be better at detecting a liar when they are both told a target is 'usually untruthful' (thus creating suspicion) and rely on accurate nonverbal cues to deception (Forrest, Feldman, & Tyler, 2004). A possible explanation thus seems to be that some level of active engagement in detection is beneficial because distinct processes are switched on.

Our indirect measures seemed to be slightly more powerful in differentiating liars from truth-tellers when participants were forewarned. One possible explanation that has been provided for the finding that indirect questions are more accurate than direct questions is that the indirect questions shift participants' attention to the appropriate cues to deception (Vrij et al., 2001). However, this explanation does not seem to account for sharpened differentiation when the aim to detect deception is salient; indirect questions have been found to discriminate between liars and truth-tellers even though participants were not informed about the reason for why they were being assessed (Ulatowska, 2010, 2014). In the current experiments, we chose to measure person impressions related to warmth because these judgments are more intuitive compared to other indirect

measures (e.g., whether the target person had to think hard). In contrast to these other indirect measures, the liking and trustworthiness judgments seem unlikely to shift attention to specific cues that indicate deception. Instead, they elicit a more holistic and affective evaluation. Relying on specific cues could be costly when beliefs about the characteristics of deceptive behavior are not correct (Forrest et al., 2004). Holistic judgments, in comparison, have more chance of getting it right if intuition based on the rich information send by liars indeed aids deception detection. This is further suggested by studies showing that task-relevant unconscious thought improves lie detection (Reinhard, Scharmach, & Müller, 2013). Indeed, the affective indirect judgments proved appropriate guides to trustworthiness even when participants were arguably not searching for cues of deception (i.e., in the not forewarned phase). We encourage future research to further test whether these holistic indirect judgments perform better when the goal to detect deception is present.

Most research on deception detection has explicitly given participants the instructions to watch a video with the goal of detecting deception (Reinhard et al., 2013). It seems, however, that this does not mimic real life situations in which people are usually not out to spot liars—notwithstanding the notable exception of law enforcement professionals. Even so, under these explicit instructions to detect deception, intuitive judgments seem to outperform deliberative ones (cf. Albrechtsen et al., 2009). Our experiments, in contrast to other experiments, were characterized by two distinct phases: One where participants watched videos while the reason for this was unbeknownst to them, and one where the goal of watching videos was apparent. This allowed us to explore differences our physiological measure for these two phases. While we had suggested that observing a liar would result in a lower skin temperature than observing a truth-teller, this was only the case when participants had a clear goal: To detect deception.

One possible explanation for this could be that while people generally go through life unsuspicious of others, when they have the goal to detect ‘threats’ in the environment their conscious as well as their unconscious reactions are conducted to respond to this threat more adaptively. One could imagine, for instance, that being more

vigilant heightens conscious processing of information while at the same time it increases the reflexive, automatic responses. It has been argued that some automatic processes are goal-dependent and require awareness of the triggering stimulus to occur (Bargh, 1994), and that external stimuli and internal determinants of behavior are mutually dependent on each other in producing adaptive responses (Fiedler, Bluemke, & Unkelbach, 2009). For instance, unintentional, spontaneous trait inferences happen with little awareness, yet they are goal-dependent in the sense that they arise when prompted by a relevant goal (Fiske & Taylor, 2013). It could be the case that similar processes were unintentionally elicited in our experiments due to giving participants the explicit instruction to form impressions of possible deceivers. Future research could examine this possibility by exploring the relationship between physiological responses and having, versus not having, a conscious goal.

When comparing the results of both studies in this chapter, the temperature pattern observed in the second phase of Study 5.1 seems to resemble the pattern observed in the not forewarned phase of Study 5.2. Although speculative, a perceivable cause of this could be that in the pilot study the forewarning was not manipulated as strong as in the current study, leaving participants still in a relatively ignorant state about what was to come and whether the experimental context was one of deception detection. Being able to expect and prepare for what is to come arguably has some advantages, although it should be noted that not anticipating threats is comparable to an everyday life situation in which people assume they will not be lied to.

Limitations and Directions for Future Research

In the pre-registered experiment detection accuracy in the forewarned phase was slightly higher than can be expected by chance, even though truth-bias was unaltered. This means that participants' judgments in the forewarned phase were less often false alarms and more often hits. This could be due to a learning effect, although this seems unlikely. Our design was set up to minimize the possibility of participants getting better over time; participants did not get feedback on their performance, videos were randomized, and the procedure of seeing a video and answering questions about it was "rehearsed" with

the nature documentary. We cannot, however, exclude the possibility that the differences between the two phases stems from the time participants were on the task, as this feature is inherent to our within-design. Similarly, we cannot exclude the possibility that the accuracy of the direct veracity judgment was assisted by the mere presence of both the indirect veracity judgments that came before it.

Next to these design characteristics, another possible explanation for the differences between our experimental phases could be that simply having thought and read about lying could make this concept more accessible, unintentionally influencing inferences and impressions of the target person to come. An intuition about a person that is based on experiential, associative knowledge might be triggered by deliberate thought (e.g., Epstein, 2003). A relevant question for future research is whether activating knowledge structures concerning distrust would lead to similar enhancement of (indirect) deception detection as we found here.

In our experiments we found liars to be liked and trusted less. A possible explanation for this effect of indirect deception detection is that liars come across more tense and may exhibit afflicting emotions related to lying, which could lead to emotional contagion. We did not ask our participants whether they themselves felt tense after seeing a liar; however, it could be argued that the temperature measurement is a proxy for this. Future research will have to identify the exact relationship between so-called indirect veracity judgments and other measures indicative of the affective state of the observer. Although emotional contagion from the liar to the observer seems plausible, on the basis of what is currently known, it is too soon to draw any conclusions. Studies where participants were asked how comfortable they felt after a deceptive message reveal contradicting patterns (DePaulo & Morris, 2004; Ulatowska, 2014), possibly due to features of the sender such as whether their task of lying was cognitively demanding or the extent to which they themselves feel comfortable lying. If contagion is indeed present, a possible prediction could be that the negative feelings elicited in the observer would aid affective judgments. However, when it comes to consciously catching the liar these feelings may induce more systematic processing and therefore hinder direct detection of veracity.

The fact that our experimental design was able to elicit changes in temperature is promising, especially in light of the fact that the use of videos to manipulate truths and lies is a minimal, albeit controlled, version of real interactions. In general, deception detection performance is equally poor when observers detect deception in a live situation compared to observing a video (for an overview, see: Landström, Granhag, & Hartwig, 2005). It is likely, however, that a target person's deceptive intent is registered as a threat to a lesser extend when presented on a video than in a real life interaction. It is also conceivable that this low level of threat might need some higher alertness or vigilance to be detected, as could be the case when being forewarned. Manipulations that aim to make the environment more unpredictable would in that case enhance the ability to detect untrustworthiness. Additionally, people who are constantly more on guard and distrusting (e.g., insecurely attached individuals) may see more deception around them. Whether they are more often accurate in these assessments remains an unanswered question. Furthermore, it may well be the case that interacting with a liar in real life is costly and aversive because the observer needs to be more on the alert. To explore this possibility and to make a broad generalization possible, more data from accumulating accounts based on different sets of videos and real life interactions is needed.

To examine the impact of deceptive messages on the observer further, more time-sensitive methods would shed light on the dynamic interplay between interaction partners and its assumingly adaptive nature. For instance, neural activity associated with observing a deceptive message could be considered, as well as mental activity as assessed by pupillary responses. Other areas of investigation involve the long-term consequences of insincere interactions on, for instance, judgments of moral character.

Conclusion

The current research is a first endeavor to explore psychophysiological underpinnings of deception detection with a special focus on thermoregulation within the observer of truthful and

deceptive messages. We found marginal significant results revealing skin temperature decreased when liars were observed, whereas temperature trajectories for observing truth-tellers were dependent on being forewarned of the possibility of deceit. Indirect judgments of liars and truth-tellers revealed that lying typically caused a person to be liked and trusted less, while accuracy on a direct judgment of whether this person was lying was barely above chance level.

Pre-registration

The aim of our pre-registered experiment was to investigate a previously unexplored part of deceptive social interactions and the role of psychophysiology (i.e., the embodiment) of these interactions on the part of the receiving end of a deceptive message. This research, fundamental in its nature, is but an example of the multitude of opportunities for further investigation—some of which we have suggested above. The fact that this research was pre-registered played a positive role in the development of our experiment and it did not constrain our curiosity for exploring the data. Working together with reviewers in an early stage maximizes chances of making a valuable contribution to current debates. In addition, this process and its open access character carry on the momentum, enabling researchers to continuously build on ongoing work. We hope to have inspired future investigations of the interaction between physiology and cognition, and the possible influences of this interaction for social relationships.

Appendix for Chapter 5: Pre-registration[15]

Proposed experiment: Aims and hypotheses

The aim of this study is to assess whether finger skin temperature differs when watching a liar as opposed to a truth-teller. Our main hypothesis is that temperature will lower during the watching of a 3-minute video clip of a liar (H1). We further hypothesize that participants will judge truth-tellers more trustworthy and likeable than liars (the *indirect* veracity judgments; H2a), with the additional hypothesis that this effect will be bigger for the trustworthiness judgment than for the liking judgment, because trustworthiness judgments are suggested to be more automatic and intuitive and would therefore tap into the covert differences between liars and truth-tellers better (H2b). Next to this, we hypothesize that when asked to judge whether a target person is lying, participants' judgment will not differentiate between liars and truth-tellers better than chance (the *direct* veracity judgment; H3). Finally, we hypothesize that the indirect veracity judgments, namely the liking and trustworthiness for the target person, are positively related to finger temperature, whereas the direct veracity judgment is not (H4). Additionally, our proposed design allows us to infer whether these effects interact with the level of awareness participants have of the fact that this is a setting in which deception has to be detected.

We regard this registered report as a unique opportunity to shed light on findings that were obtained in our pilot study. We aim to improve on the methods used in the pilot study by now also including a measure of trustworthiness, and by measuring the direct veracity judgment with a binary choice option, in order to be able to compare our participants' performance in detecting deception to performance

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[15] From the experience of this pre-registration as well as other pre-registrations, a pre-registration template was made and perfected in order to facilitate and standardize the process of pre-registration. The latest version can be downloaded online (https://osf.io/k5wns/), filled out, uploaded to one's own account on a platform such as the Open Science Framework (http://osf.io), and time-stamped as a (reviewed or unreviewed) pre-registration (see van 't Veer & Giner-Sorolla, 2015).

on the basis of chance (see H3). We aim to replicate the findings of the pilot study that truth-tellers get more positive judgments on *liking* (and for the proposed study, also on trustworthiness, see H2a) and that finger skin temperature was positively correlated with this (see H4). Most importantly, we aim to better test our prediction that we make on the basis of thermoregulation in (dis) trusting interactions that we will observe a lowering in finger temperature when watching a person who is dishonest compared to honest (see H1), by now allowing more time for participants to reach stable temperature.

Description of proposed sample characteristics

The proposed sample will consist of the Tilburg University lab participants, a sample that on average consists of about 65% females, 95% University students who are mainly Psychology undergraduates around the age of 21, who participate for course credit or an hourly pay of €8. We propose to run at least 120 participants (see below). We will apply several exclusion criteria. First, participants who have prior experience with the temperature measure (and its debriefing) will be offered participation in another study and will be refused participation in the current study on theoretical grounds, as people may be able to consciously control their own finger temperature (Keefe, 1978). Second, participants will be excluded from analyses if they are acquainted with one or more of the people depicted in the video material (assessed after all dependent measures). This is done because knowing the target person in this case will almost always result in being able to tell whether what the person is saying is true (e.g., recognizing someone from a psychology class while this person faints an education in another area). Third, participants will be excluded in the following instances: technical failure of temperature measurement, defined as either a software error, crashing of the computer program or a failure on the experimenter's part to correctly start measurement or save it (in which case no temperature recording is present for this participant, yet other dependent measures may be present).

Contrary to what was done in previous research (IJzerman et al., 2012), we will also run exploratory analyses without participants who fail to reach 30 °C during watching of the neutral movie, as some

authors have argued that fingertip temperature should be high enough to observe vasoconstriction (i.e., it should be physiologically possible; Kistler et al., 1998). The analyses including these participants are the main analyses. Analyses will also be run both with and without heavy smokers (more than 20 cigarettes a day) as smokers can have trouble warming up after cooling down (Cleophas, Fennis, & van't Laar, 1982), the analyses without them being conclusive. Outliers are defined as having an unlikely to be correct bodily temperature, cut offs set at below 18 °C and above 37 °C. If outliers are present in the data, we will employ a jackknife methodology to confirm the robustness of the results and report differences in outcomes in a footnote.

Procedure

Possible participants will enter a draftless lab room with a maximum of 12 at a time. They will be led to an individual table with a computer separated by screens, where they sign for informed consent. A maximum of six participants will be participating in the current study at a given time. After completing half an hour of unrelated tasks (to allow for acclimatization to the room temperature), the experimenter will set up the current experiment run in both Authorware and, for the temperature measure, OneWireViewer. Participants' finger skin temperature will be measured with a so-called iButton (see Pouw, Flore, & IJzerman, 2012, for software and instructions), introduced to the participant as 'a battery measuring a physiological response'. The iButton will record temperature every second. The iButton clock will be synchronized to system seconds, and the start and end time of all videos shown will be saved in Authorware (which also relies on system seconds to retrieve the current time). During the time the experimenter starts the temperature log, the participant will be asked to clean their fingers with an antibacterial wipe and to indicate which is their dominant hand. After this the experimenter will attach the iButton to the palmar surface of the distal phalange of the non-dominant index finger with a double-sided EEG sticker. The participant will then be instructed to comfortably lay their forearm on the table with the iButton facing up, and to start working through the experiment in Authorware.

All participants will first see part of a nature documentary for a minimum of 8 minutes allowing for the iButton to reach finger temperature, and for the participant to reach a stable starting temperature. Two filler questions about this documentary will be asked to seemingly give the documentary a purpose and to acquaint the participant with the overall procedure of watching a video and subsequently answering questions about it. Next, the participants will be told they will now watch a series of different videos. They are explicitly informed that these videos will be presented in blocks and that questions will follow after each block. Each block contains two videos and thus after two videos questions will be asked about the person in both videos. The participant is not told the total number of videos that will follow, to minimize their possible tendency to expect 50% of the videos to be untruths. In reality, four videos will be shown in total (see Video material), divided in two blocks of two videos. Each block consists of one liar and one truth-teller, randomly presented. The gender of the person on the video will also be varied to make sure lies are not confounded with gender.

After each block of two videos, the participant will answer three questions about each video. Firstly the *indirect* deception judgments are assessed with two counterbalanced questions: "How much do you like the person in the first [second] video?" and "How trustworthy did you think the person in the first [second] video was?", responses will be given on a 7-point scale, ranging from 1 (*not at all*) to 7 (*very much*). Thirdly, the *direct* deception judgment is assessed with the question: "Did you think the person in the first [second] video was telling the truth?" (*yes* vs. *no*). Note that the nature of the questions about the target person is thus revealed after block 1, and that the participant now knows that the possibility exists that the person in the video is insincere. To strengthen this manipulation of the level of this awareness, participants are told that for the next block of videos, they will receive the same three questions about the target person. The three questions will also be presented to the participants again in order to make sure they realize what they will be asked after the next videos. This allows us to compare our dependent measures in both blocks to examine the effect of this awareness of possible deception. Lastly, the participants will provide information on their

gender, age, smoking behavior, acquaintance with any of the people depicted in the videos, dominant hand, and their thoughts on what the study was about. The iButton will then be detached and the participant will be thanked and debriefed.

Video material

Videos used in this study will display two men and two women who have each been recorded separately while they introduce themselves for three minutes, once truthfully and once deceptively, making eight videos in total[16]. These targets were instructed to give an impression of themselves, talking about topics like their personality, interests, family situation, childhood, education, and work situation. As people frequently lie to make a good impression, for instance in job interviews (Weiss & Feldman, 2006), impression management is a topic particularly relevant to the current study. Additionally, it has been found that both men and women who have a self-presentation goal (i.e. to appear likable or competent), compared to those who don't have this goal, lie significantly more in real-life interactions (Feldman, Forrest, & Happ, 2002). In our opinion, this makes having to form an impression of a person in a video who is trying to leave a good impression an appropriate setting in which to examine the participants' physiological responses to deceit. Targets in the videos read instructions that told them they were randomly assigned to tell the truth first, and then lie, to another participant (who, in fact, was a confederate). They were instructed to talk about themselves for three minutes truthfully, and were told that three minutes would feel like a long time, so they should try to give a complete picture of different aspects of themselves. They directed their speech to the confederate, who sat next to the camera. After giving this true impression the confederate briefly left the room, supposedly to fill out a questionnaire. During this time, the target person was instructed to give an impression of themselves for a second time when the confederate returned, while this time being untruthful. The confederate then came in again for this second recording, and was

[16] Notice that of the eight videos, a given participant is only shown four. This ensures that participants do not see a lie and a truth of the same target person.

supposedly going to guess which one of the two times an impression was given would be the truth.

Proposed analysis pipeline

The following pre-processing steps will be taken. First all individual temperature data files will be jointly imported to SPSS with 'TempToSPSS', a piece of software custom programmed by SpITs, the Tilburg University IT department. Authorware data will also be joined and subsequently these two datasets will be combined. As the Authorware dataset will contain a variable indicating the time of a given video and the order in which the program randomly displayed the videos, new variables can be made indicating at what point in time (thus belonging to which temperature data) which of the nine videos was displayed to the participant (neutral nature video clip or one of the eight videos of 4 targets lying or telling the truth), and whether a liar or a truth-teller was in it. Next, a new time variable will be made that starts at 0 for each new video encountered by the participant, allowing the temperature data to be displayed and analyzed over time, collapsing over videos (all SPSS syntax steps openly available online). For each video that a participant is watching, we will compute the participants' temperature minus their temperature at the beginning of this video, in order to ensure that any differences between participants' temperature at the beginning of the video will not influence the outcomes. This way, we make sure that individual carry-over effects from the last video that was watched are kept to a minimum.

In the statistical models described below we refer to the experimental factors in the following way: The factor veracity, representing whether the person on the video was lying or not, the factor awareness, representing whether the participant was aware of the possibility of being lied to or not, and the factor order, representing whether a liar was shown first and then a truth-teller, or vice versa.

To analyze the indirect veracity judgments, to test whether truth-tellers compared to liars get higher judgments (see H2a) we will estimate separate linear mixed models, one with liking and one with trustworthiness as the dependent variable, and with the experimental

factors veracity, awareness and order as independent variables. To analyze the direct veracity judgment ("Is this person lying, yes or no?") to test whether truth-tellers compared to liars get different judgments we will estimate a mixed logistic model with this binary variable as the dependent variable and veracity, awareness and order as independent variables. The same model will allow us to test whether the judgments in each experimental phase deviate from chance (i.e., equal probability), thus providing a test of accuracy (see H3). Furthermore, we will compute a variable indicating whether the participant made a correct direct veracity judgment for each video. A mixed logistic model will be used to assess the relationship between this indication of accuracy and the participants' mean temperature per video across different experimental phases (unaware vs. aware). Using a random coefficients regression we will also assess the relationship between temperature and both liking and trustworthiness (see H4).

The main statistical analyses' aim is to estimate the effects of veracity of the person on the video (lie vs. truth; see H1) and deception-possibility-awareness of the participants (aware vs. not aware) on participants' temperature. In order to ease interpretation, we will center time as was done for the pilot study. Using linear mixed models (SPSS mixed), a model will be built to define the trajectory of temperature over time (with linear and polynomial effects of time), as a function of veracity and awareness. Order of both the independent variable (veracity) and the dependent variables (liking and trustworthiness) will be considered in the analysis with its main effect and interactions with the experimental factors. All repeated measures effects—intercept, polynomial time, awareness, and veracity—will be allowed to vary randomly, removing those effects that show no variability across participants. Variances and covariances will be tested with Wald tests against the null hypothesis of no variance, but any parameter greater than zero will be left as random (Littell, Pendergast, & Natarajan, 2000). When the random components are ascertained, we will estimate the complete model using restricted maximum likelihood. Sattherwaite approximation of the degrees of freedom will be used (West, 2009). Specifically, this full model has ID (participants) as subjects variable, includes temperature as the dependent variable, and time as the continuous (polynomial)

independent variable, veracity, awareness and order as predictors to the model. This model estimates the main effect of type of video, the main effect of deception-possibility-awareness, the main effect of order, their interactions and the interaction of the experimental factors with time. This last effect informs on whether the temperature trajectories change depending on the veracity and awareness. Order of the videos is added to the model to account for any order and carry over effects; if order interacts with the experimental factors we will discuss implications of this for the validity of the results, if order has a main effect, taking this variable into account strengthens the models' statistical power.

The most important effects these models allow us to estimate are the interaction effects of our experimental factors and time, because the expected change in temperature due to the experimental factors should unfold over time. For exploratory purposes, we will run our full model with gender as a fixed predictor to see whether it interacts with any of the experimental factors (if this reveals an interaction with the experimental factors, we will leave Gender in the model that we report in our results section).

In short, we will regard H1 as confirmed if the average skin temperature of participants while watching a liar is lower than when watching a truth-teller. This should translate into an interaction between veracity and time, and possibly a main effect of veracity. We will regard H2a as confirmed if liking and trustworthiness are significantly higher for the truth-tellers compared to the liars, and H2b as confirmed if the effect size of this effect is larger for trustworthiness than for liking. We will regard H3 as confirmed if the overall proportion of correct veracity judgments made by the participants is not significantly different from equal probability or if it is significantly different from equal but lower (due to truth-bias). We will regard H4 as confirmed if liking and trustworthiness are significantly positively related to temperature and partly confirmed if either one of these indirect measures is, whereas accuracy (on the direct veracity judgment) is not.

Statistical power analysis

For temperature measurements in experiments about social relations, effect sizes in the literature are scarce, although some do exist. For instance, IJzerman et al. (2012) found a *B* of -0.011 for the effect of being excluded during an experiment that employed a ball-tossing game. As our proposed stimuli are hypothesized to elicit an unconscious reaction, we argue the change in fingertip temperature could be even smaller than this, and therefore we aim to have as many participants as possible. For our design and our specific needs we were not confident in proposing an appropriate way of determining sample size. For this reason we propose to go beyond the sample size suggested for a between-subjects design, namely the suggestion for the rule of thumb to have a minimum of 50 participants in each condition (Simmons, Nelson, & Simonsohn, 2013). With our exclusion criteria in mind, we set out to run a minimum of 120 participants. Note that the above-mentioned rule of thumb is based on a between-subjects design, and our design repeatedly measures participants' temperature for both lies and truths, thus is a within-subjects design. This means we will collect a minimum of 160 temperature observations (measured each second of video material) four times per participant (during the first and second lie and first and second truth). Thereby, this design increases the probability of finding a finger temperature difference between perceiving truths and perceiving lies if one exists.

Chapter 6
Effortless physiological responses in the eyes of the beholder of honesty

Previous research suggests that people can have correct intuitions about whether they are being deceived, and that this detection of deception may take place below the threshold of consciousness. In the current chapter we examine this suggested intuition by monitoring pupil diameter while participants viewed targets who, unbeknownst to the participants, were either lying or telling the truth. Differential pupillary changes were found in response to the targets' veracity. When participants watched a dishonest compared to an honest target, an initial pupillary increase and a subsequent decrease was found. Results of participants' self-reported veracity judgments indicated that a correct intuition about the target's veracity was reflected in affective evaluations (i.e., truth-tellers were liked more) but not in direct veracity judgments (i.e., truth-tellers were not judged to be less deceptive). Findings of this chapter highlight the possibility of unconscious deception detection.

This chapter is based on: van 't Veer, A. E., Stel, M., & van Beest, I. (2015). *In the eye of the beholder: Observers' pupillary responses and affective reactions toward deception.* Manuscript submitted for publication.

Chapter 6: Effortless physiological responses in the eyes of the beholder of honesty

Theoretical as well as empirical accounts suggest that people may possess an ability to detect dishonest intentions in others (i.e., cheater detection; Cosmides, Barrett, & Tooby, 2010; Verplaetse, Vanneste, & Braeckman, 2007). Although work on deception detection suggests that judgments of veracity are not very accurate (Bond & DePaulo, 2006), on an intuitive level there may be some form of detection present. For instance, detection of deception seems to fare well under cognitive load (Albrechtsen, Meissner, & Susa, 2009), after unconscious thought which is presumed to diminish top-down influences (Reinhard, Greifeneder, & Scharmach, 2013), and when measured on a more implicit level (ten Brinke, Stimson, & Carney, 2014). Together with other research showing the effectiveness of fast and automatic judgments of moral character (e.g., Bonnefon, Hopfensitz, & De Neys, 2013; Willis & Todorov, 2006), this makes an appealing case for intuitive deception detection.

Correct intuitive judgments about whether another person is lying may stem from unconscious deception detection, however, this detection may occur at such an early stage that it often does not permeate consciousness. This may explain why people's accuracy in detecting deception by explicitly judging veracity is—although in the statistical sense significantly higher than chance—not very high (i.e., 54%; Bond & DePaulo, 2006). Judgments that do not explicitly ask about the veracity of another person, often called indirect veracity judgments, in contrast, have been found to distinguish liars from truth-tellers (DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997; Ulatowska, 2014; van 't Veer, Stel, van Beest, & Gallucci, 2014; Vrij, Edward, & Bull, 2001). For instance, when asked how trustworthy a target person is, participants rate liars lower than truth-tellers even though they are not aware of the fact that they are being lied to (van 't Veer, Gallucci, Stel, & van Beest, 2014). In an attempt to find a marker of unconscious deception detection, van 't Veer et al. (2015) measured finger skin temperature, and suggested that observing a liar could influence the physiology of the observer. Given these findings, one may expect that a much more time-sensitive physiological

marker, namely the observers' pupillary response, could reveal an unconscious reaction towards dishonesty.

Pupillary responses signal changes in mental states that occur outside of awareness (Laeng, Sirois, & Gredeback, 2012). Pupil dilation occurs together with, among other things, increased cognitive load (Beatty & Lucero-Wagoner, 2000), emotional arousal for both positive and negative stimuli (Bradley, Miccoli, Escrig, & Lang, 2008), the detection of perceptual anomalies (Sleegers, Proulx, & van Beest, 2015), and error detection (Critchley, Tang, Glaser, Butterworth, & Dolan, 2005). Even thought presented stimuli often remain unconscious, they affect pupillary responses and their presence can still influence judgments and behavior (Laeng, et al., 2012). Recent theorizing suggests that aversive stimuli elicit an initial response of vigilance, arousal and avoidance (Jonas et al., 2014; Sleegers & Proulx, 2015), which can be measured with pupillary responses (Sleegers et al., 2015). The pupil thus seems a relevant indicator of the brain's ability to detect certain abnormal events in the environment. Dishonesty—especially when contrasted with honesty—could be such an abnormality. If so, it can be predicted that a pupil arousal response (i.e., dilation) occurs when dishonesty is observed.

With the current chapter we examine whether pupillary responses are differently affected when observers are watching targets that—unbeknownst to the observer—are either lying or telling the truth. Specifically, an increase in pupil size is expected when dishonesty is observed. These kind of physiological underpinnings of observers' intuitions towards (dis)honesty have been hitherto underexplored. Furthermore, we assess deception detection ability with both a direct veracity judgment (i.e., is the target person honest about whether they cheated?) as well as an indirect veracity judgment (i.e., how much do you like this target person?). We predict that—as previous research suggests—the direct veracity judgment does not distinguish between liars and truth-tellers, whereas the indirect veracity judgment is able to do so. We thus expect to find that the detection of (dis)honesty is reflected in an unconscious physiological response and in an affectively based judgment, rather than in a cold cognitive judgment.

Method

Participants and design

Forty-four Tilburg University students—31 females, 2 unknown, M_{age} = 20.12, SD_{age} = 1.65 (age of 2 unknown) —took part in this study in return for money (€6) or course credit. Sample size came about by running the study for the two weeks it was planned for. The experiment was programmed in Tobii Studio. We report all data exclusions (there were none), all manipulations, and all measures in the study.

Material and procedure

Participants watched six videos (Levine, 2007) that lasted a little over two minutes (M = 2.29, SD = .19) in random order in which a target person was displayed answering questions posed by an interviewer. The target, but not the interviewer, was visible sitting on a chair. The interview included several questions about a trivia game the target participated in earlier. During this trivia game the experimenter had left the room for a short while, and via the use of a confederate who ostensibly participated in the game it was known whether targets had cheated in this game. Towards the end of the video of the interview the question of interest was asked: "Did you cheat on the trivia game when the experimenter left the room?" All targets (three males, three females) spontaneously negated this, although half was known to be lying. In keeping with the exploratory nature of this experiment, we chose to measure pupillary responses in a time window of ten seconds starting from the moment the interviewer's question ended. This ensured we captured the targets answer to the question (i.e., their denial of having cheated) and their subsequent demeanor. Participants' eye movements were recorded with a Tobii T60 eye tracker (17 inch TFT monitor) with a sampling rate of 60 Hz. A Modified Repeated Median filter (Bernholt, Fried, Gather, & Wegener, 2006; Fried, Schettlinger, & Borowski, 2012) was applied to the pupil size data in order to reduce measurement noise (e.g., spikes) and linear interpolation was applied to missing data (e.g., blinks).

After watching each video participants first made an indirect and then a direct veracity judgment about the target. The indirect veracity judgment was measured by asking: "How much do you like this person?". The direct veracity judgment was measured by asking: "To what extend do you think this person was lying about having cheated?". Both scales ranged from *not at all* (0) to *very much* (7).

Results

Pupil diameter

Figure 6.1 displays participants' pupil diameter over a 10 second period when watching a dishonest or an honest target answer the 'did you cheat'-question. Irrespective of the veracity of the target, there is an overall wave-like pattern that may likely reflect pupil response for the common procedure of hearing the answer of the target. To test whether this pattern was different when observing a dishonest compared to an honest answer we ran a Mixed Model analyses predicting pupil diameter. There was no average effect of the target's veracity, b = -.003, $F(1, 8802)$ = .07, p = .79, however, there was an interaction between time and veracity, b = -.008, $F(2, 8802)$ = 20.13, $p < .001$. This indicates that, over time, when watching a dishonest compared with an honest target the pupil diameter first increased more and then decreased more. As can be seen in Figure 6.1, dishonest answers resulted in the greatest pupil arousal response measured at around 4-5 seconds from the onset of the targets' response to the question whether they had cheated.

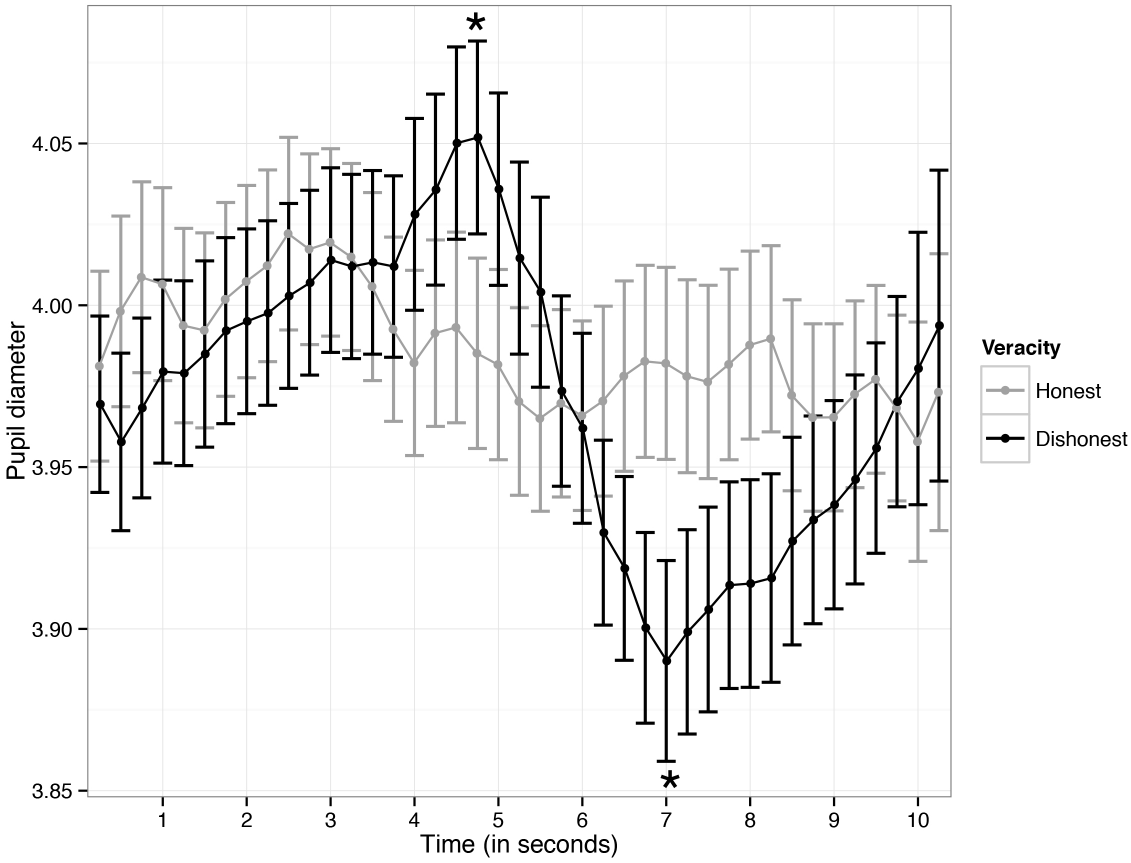

Figure 6.1. Pupil diameter over time by target's veracity (honest vs. dishonest answer to the question 'Did you cheat?'). Error bars display 95% confidence interval.

Gaze direction check

To check whether the results were impacted by other factors we also examined areas of interest (AOI) as an indication of whether similar information was attended to for dishonest and honest targets. These areas were defined with an eclipse drawn over the face of the target. This allowed calculation of the amount of time (percentage) the participants' gaze was directed at the face or somewhere else during the 10 seconds that followed the interviewers question to the target. Although a paired samples t-test indicated that participants were looking towards the face of dishonest targets less (54.53%) than that of honest targets (59.20%), $t(43) = -2.24$, $p = .03$, 95% CI [-8.88, -.46], $d_Z = .34$, this difference was already present at the beginning of the 10 second time period and stayed stable, suggesting that any

differences found in pupil dilation are not due to gaze direction. In other words, closer inspection revealed that participants' tendency to look at the face of the target was not the cause of the observed spikes in pupil size.

Veracity judgments

Figure 6.2 displays participants' indirect (i.e., liking) and direct veracity judgments. A 2 (veracity: dishonest vs. honest) × 2 (method: direct vs. indirect) within subjects ANOVA was run on participants' self-reported judgments. This revealed no main effect of veracity, $F(1, 43) = .69$, $p = .41$, $\eta_p^2 = .02$, and a main effect of method, $F(1, 43) = 4.06$, $p = .05$, $\eta_p^2 = .09$, which was qualified by an interaction, $F(1, 43) = 16.48$, $p < .001$, $\eta_p^2 = .28$. This interaction indicated that whereas dishonest targets were liked less ($M = 4.77$, $SE = .11$) than honest targets ($M = 5.20$, $SE = .10$), $F(1, 43) = 11.85$, $p = .001$, $\eta_p^2 = .22$, 95% CI [-.67;-.18], dishonest targets were not judged significantly more or less dishonest ($M = 5.34$, $SE = .14$) than honest targets ($M = 5.11$, $SE = .16$), $F(1, 43) = 2.28$, $p = .14$, , $\eta_p^2 = .05$, CI [-.08; .55]. Similarly, whereas participants tended to like dishonest targets less than they tended to think the targets were lying, $F(1, 43) = 15.48$, $p < .001$, $\eta_p^2 = .27$, CI [-.86; -.28], for honest targets, there was no difference between how much they were liked and how deceptive they came across, $F(1, 43) = .41$, $p = .53$, $\eta_p^2 = .01$, CI [-.20; .38].

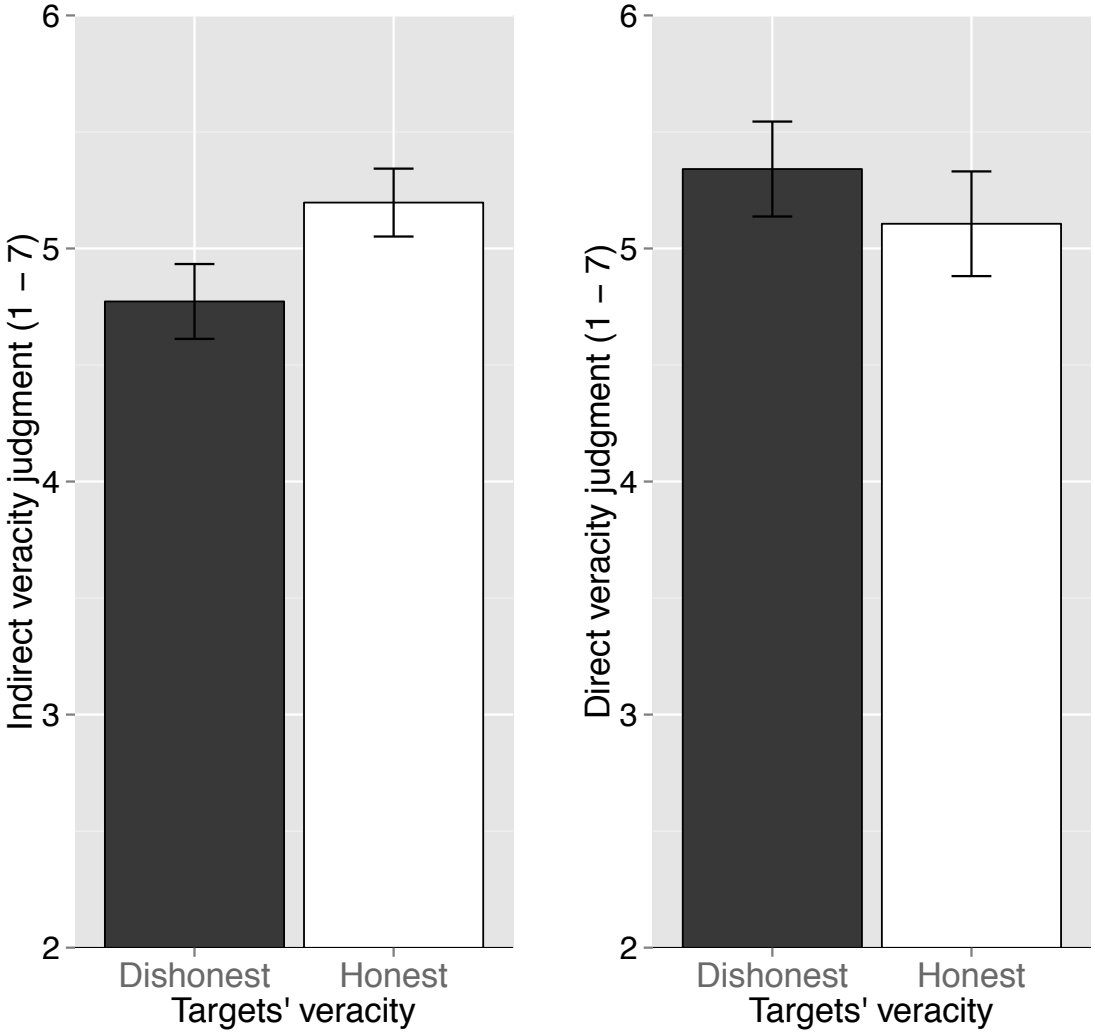

Figure 6.2. Indirect (left panel) and direct (right panel) veracity judgments for dishonest and honest targets. Error bars display standard errors.

Discussion

Can people discern whether they receive an honest or a dishonest answer to the question "did you cheat in that trivial game?", and does this ability reach the conscious assessment of others? The present research demonstrated that while a direct judgment of whether another person is lying did not distinguish honesty from dishonesty, an affective indirect judgment did; truth-tellers were not judged to be more or less deceptive, however, they did receive more positive affective feelings. The results further suggest that (dis)honesty may be

unconsciously perceived. That is, dishonest answers evoked greater pupillary responses. Pupil size first increased more and then decreased more when watching a dishonest compared to when watching an honest answer. This initial increase seems an especially promising lead in the investigation of unconscious deception detection, as it was exactly this period where the targets first negated having cheated. Together these findings suggest that even though conscious judgments are often led astray, the ability to detect deception may be present on a nonconscious level.

Our results are consistent with previous findings advocating the merit of unconscious deception detection (Reinhard et al., 2013; ten Brinke et al., 2014). Detection of an unexpected or aversive signal emanating from the deceiver and the following lowered affect could be analogous to vigilance and subsequent avoidance of untrustworthy others (Todorov, 2008; Tolin, Lohr, Lee, & Sawchuk, 1999). The initial increase in pupil dilation that was found when participants were watching a dishonest target might reflect an increase in sympathetic activity associated with preparedness to respond adaptively. Pupil dilation occurs with cognitive processing and attention as well as emotional arousal (Beatty & Lucero-Wagoner, 2000; Bradley et al., 2008; Hermans, Henckens, Roelofs, & Fernández, 2013; Partala & Surakka, 2003). This reaction thereby reflects the importance of the allocated resources and affective preferences relevant to what is observed. A visceral response of this kind may thereby facilitate the process of forming an impression of the trustworthy intentions of others.

With regard to the impression that people form of (dis)honest others, it seems that these correct intuitions remain largely unconscious. Consistent with earlier findings, the direct veracity judgment did not discriminate lies from truths whereas the indirect veracity judgment was able to distinguish between truth-tellers and liars (van ’t Veer et al., 2015). In the current chapter, instead of indirectly assessing a veracity judgment by asking about the targets’ demeanor (Vrij et al., 2001) or the observers’ confidence in their judgment (DePaulo et al., 1997), the indirect judgment was specifically aimed at affective reactions. These judgments may indirectly tap into a visceral reaction and thereby reflect felt emotions

towards the target. These kind of 'warmth' judgments—suggested to be fast and automatic (Fiske, Cuddy, & Glick, 2007)—may be borne out of a physiological reaction that marks the (un)friendly intent of others.

The design of the current experiment was based on within subject trials that consisted of videos of spontaneously dishonest and honest targets. We recognize that it is important for future efforts to increase the amount of trials and to examine psychophysiological responses for dishonesty recorded with a range of different procedures. Notwithstanding this, the findings underline the importance of the study of psychophysiological responses within the detector of dishonesty. Findings provided further evidence for the superior ability of indirect veracity judgments as compared to direct veracity judgments, suggesting emphasis on people's affective response when inferring intentions of others is warranted. Furthermore, the current eye tracking results extend previous findings in the area of deception and cheater detection by virtue of exploring the possibility of the existence of physiological markers of deception detection. We recommend future research to continue focusing on pupillary responses of observers of dishonesty and to disentangle responses to various indicators of deceit, such as auditory cues and facial expressions. For, as the current results denote, the ability to detect deception resides in the eye of the beholder.

Chapter 7
General discussion
and
directions for future research

Chapter 7: General discussion and directions for future research

People's daily lives are filled with moral concerns about their own and others' behavior; people's moral actions and their ability to discern the moral character of others shape interpersonal relationships. It has been argued that people make cost-benefit analyses of self-interest when making moral decisions, and that when they carefully consider the right cues this may lead to accurate assessment of others. However, as I have highlighted in the current dissertation, regulating social relationships in an advantageous way requires effortless moral judgments and decisions, often made under circumstances that are not equipped for moral deliberation. More specifically, my aim was to show that to understand the elements of a deceptive interaction, it is important to take into account the degree to which processes within the deceiver as well as the deceived require cognitive effort. Below I give an overview of the main findings, I discuss what these findings tell us about the workings of dishonesty, and I provide directions for future research. While touching upon these issues I describe several studies that did not make it into the main chapters. Instead of clogging up my file drawer, these studies can inform research still to come.

Main findings

The aim of Chapter 2 was to establish direct evidence for the prediction that being dishonest takes more cognitive effort than being honest. Participants' capacity to deliberate was hindered with an often-used manipulation that limits available processing resources[17].

[17] Actually, the existing cognitive load manipulation was modified slightly; I used a string of letters instead of the typically used string of numbers. Participants were asked to either remember a long string of eight letters that corresponded to my passport number at the time (NWRBRKPJ; high cognitive load), or a short two letter combination that corresponds to similarly ordered letters in both the alphabet and the name of a Dutch airline (KL; low cognitive load).

Furthermore, in contrast to previous research, the procedure of a die-rolling task was adjusted in order to limit participants' opportunity to decide to be dishonest before this manipulation was introduced. Results revealed that for participants who were under low cognitive load the reported outcomes of a die roll that was to be paid out, but not other rolls, were higher than can be expected by chance. This suggests that participants in this condition were reporting higher outcomes than they had actually obtained in order to get more money. In contrast, participants who were under high cognitive load did not report higher numbers than an 'honest' distribution expected by chance. Together this suggests that although in an anonymous, tempting situation people often show dishonest behavior, having limited cognitive capacity eliminates this dishonesty. As such, results of Chapter 2 suggest that honesty, not dishonesty, is the 'intuitive default'.

Chapter 3 was designed as a first test of the strength of affective judgments in discerning dishonesty. It was suggested that if these judgments are indeed an indication of a correct intuition of another person's intent, that then it can also be expected that out of several indirect judgments, these affective judgments would be the most reliable guides to (dis)honesty. Additionally, it was proposed that if impressions of liking are automatically formed, they should distinguish between truth-tellers and liars even in a situation where other judgments may fail to do so, namely when stories are rehearsed. Results indicated that when participants made direct veracity judgments these judgments distinguished between dishonest and honest stories when these stories were told spontaneously, but not when they were rehearsed. Importantly, the judgment that was theorized to be the most effortless, namely the indirect affective judgment of liking, was able to distinguish liars from truth-tellers irrespective of whether stories were rehearsed. Specifically, truth-tellers were liked more than liars, even when stories were rehearsed, suggesting that these affective judgments are valuable guides when assessing deceptiveness.

Chapter 4 focused on the influence of being in a state of stress on people's ability to detect dishonesty. Next to the direct 'Is this person lying?' question, an indirect veracity judgment was asked

which is an affective judgment closely related to the above-mentioned liking judgment, namely the judgment of whether the other person is trustworthy. Stress was induced in half of the participants with an anticipatory stress paradigm: participants were asked to prepare a public speech. Before participants actually gave this speech, they were asked to detect deception and trustworthiness from videos of targets who were being honest or dishonest about their identity. Results indicated that with the direct veracity judgment, participants were not very accurate when detecting deception. With the trustworthiness judgment, however, participants judged truth-tellers to be more trustworthy than liars, especially so when they were under stress. This suggests that sensing another person's honesty is best served by relying on effortless modes of processing.

In Chapter 5 the aim was to investigate whether intuitions toward (dis)honesty reflect themselves in the physiology of the observer. Because previous research established a connection between temperature and trust, people's finger skin temperature was measured while they were watching videos of targets who either lied or told the truth about topics like their personality and family situation. Results indicated that finger skin temperature was differentially affected by observing a dishonest compared with an honest target. When observing dishonesty, temperature declined over time, irrespective of whether participants were forewarned of the fact that a target may have been lying. However, when observing honesty, changes in temperature depended on whether participants were forewarned or not. Specifically, when not forewarned, participants' average finger skin temperature dropped below their temperature for observing liars. When participants were forewarned, their temperature was higher when observing honest others than when observing dishonest others. Changes in temperature over time thus interacted with whether observers were forewarned, and it seemed that being given the goal to detect deception aided gut feelings toward (dis)honesty. Therewith, Chapter 5 is the first in its kind to provide evidence for the possibility of unconscious physiological indicators of deception detection. Next to this physiological measure, findings pertaining to the direct and indirect veracity judgments were replicated and extended. Furthermore, because the studies in this chapter used different videos

than the studies in the previous chapters, this allowed for a test of robustness of the previously described findings pertaining to affective indirect veracity judgments.

Chapter 6 again focused on a physiological response within the observer, and builds on the previously found indications for an unconscious ability to detect deception. This time, a more time-sensitive measure than finger skin temperature was taken, namely pupillary responses. Next to pupil diameter and gaze direction, again a direct as well as an indirect veracity judgment was assessed for honest and dishonest targets. Targets on the videos that were used in this chapter responded—without being instructed to do so—either honestly or dishonestly to the question whether they had cheated on a trivia game that preceded the video recording. When participants watched a dishonest compared to an honest target, an initial pupillary increase was found, even though the face area was monitored similarly for honest and dishonest targets. Providing additional support for the robustness of the findings described in Chapter 3-5, again the indirect veracity judgment distinguished truth-tellers from liars. In this chapter, targets that lied when they denied having cheated were liked less than targets that were honest when denying this. This chapter thereby provides further evidence for the merit of looking at effortless processes within (dis)honest interactions.

Effortless honesty

The results concerning the cognitive effort involved in being dishonest (Chapter 2) provide several important insights for future research. I chose to take an approach with a focus on cognitive effort because previous findings have provided mixed evidence for the question of whether people's automatic tendency is to be honest or dishonest. This mixed evidence is likely the result of the fact that research in this area has primarily focused on time as an indication of deliberation. For instance, findings suggest that people are more dishonest when they are under time-pressure compared to when they have no time limits (Gunia, Wang, Huang, Wang, & Murnighan, 2012; Shalvi, Eldar, & Bereby-Meyer, 2012), yet other findings

directly contest this (Foerster, Pfister, Schmidts, Dignath, & Kunde, 2013). Because there is arguably some time for reflection in many studies that use time pressure (for instance when a decision has to be made within 8 seconds), these studies do not provide convincing evidence to be able to tell whether it is automatic selfishness that drives dishonesty, or whether even this selfishness is a consequence of balanced reasoning. By examining this question while looking at the cognitive effort—rather than the amount of time—that is required to be dishonest, Chapter 2 shed light on the apparent contradiction; it was found that being dishonest takes more cognitive effort than being honest.

Although economic models of deception have changed their assumptions about dishonesty over the years, they always seem to presume a primary role of deliberative reasoning. Strict views of people being either always self-interested (and thus dishonest) or honest if the gain from dishonesty does not maximize outcomes by a large enough margin (Koford & Penno, 1992), have moved to more nuanced views that incorporate not only personal outcomes but also the outcomes of others and the process that leads to these outcomes (Gneezy, 2005; Koning, van Dijk, & van Beest, 2010). These models assume that a certain kind of balancing of the costs and benefits of deception takes place. Although I do not dispute that this kind of balancing is often present, as I suggested in Chapter 2, current tests of whether the decision to be dishonest happens fast or slow are inconclusive in determining what amount of reflection may, or may not, have taken place. Chapter 2 thus contributes to our general understanding of (dis)honesty by examining the prerequisites of this behavior. It was found that when enough cognitive capacity is available *and* people can serve self-interest, dishonesty often takes place. This suggests that cognitive effort is needed when deceiving others. Whereas other models have presupposed cognitive capacity for, for instance, computations of the balance of costs and benefits of deception (Lewicki & Robinson, 1998; Schweitzer, Ordóñez, & Douma, 2004) or the instrumental value of it (Koning et al., 2010), this chapter adds depth to the understanding of deception by stressing the importance of the availability of cognitive capacity.

The finding that dishonesty takes more cognitive effort than

honesty (Chapter 2) is in line with research in other areas, such as evolutionary, developmental, and neuropsychology. In these areas, converging evidence reveals that dishonest behavior is more complex and effortful than honest behavior. For instance, taking deception as a measure of cognitive sophistication in primates, it seems to be the case that deceit is a matter of neural computation. Although many primates hold deceit as a survival strategy—suggesting natural selection does not necessarily favor honesty—not all of them are equally capable of deceit. In fact, the bigger the size of the neo-cortex in a given species, the higher the frequency of the use of tactical deceit (Byrne & Corp, 2004). Furthermore, children's ability to lie develops with age, and it is closely related to other signs of mental sophistication (e.g., "Theory of mind"; Talwar, Gordon, & Lee, 2007). Lies also elicit more activation in the brain than truths (Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003; Langleben et al., 2002; Lee et al., 2009) and typically, when lying, it takes people longer to respond to a question than when they tell the truth (Farrow et al., 2003, Spence et al., 2001). Next to recent research that revealed the liar's heightened effort by measuring their non-visual saccadic eye movement (Vrij, Oliveira, Hammond, & Ehrlichman, 2015), Chapter 2 provides direct evidence for the idea that lying requires more effort than telling the truth.

Furthermore, as Teper, Zhong and Inzlicht (2015) have also noted, the research described in Chapter 2 is one of the few cases in the moral psychology literature that includes a measure of actual moral behavior. The examination of this behavior further adds to the existing literature by virtue of its emphasis on the amount of cognitive effort involved. Several related topics can likewise benefit from this emphasis. In moral psychology, the question whether in social dilemmas people act out of selfish concerns and whether this is driven by intuition or deliberation has recently received substantial attention (e.g., Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Haidt, 2001; Rand et al., 2014; Rand, Greene, & Nowak, 2012; Zaki & Mitchell, 2013; Zhong, 2011). A dual-process framework is applied where people are believed to rely both on automatic, sometimes called intuitive, processes, and more deliberative or controlled processes (Evans, 2008; Kahneman, 2003). Because the former processes are

presumed to be fast, there is a strong emphasis on correlational studies using reaction times (e.g., Lohse, Goeschl, & Diederich, 2014; Lotito, Migheli, & Ortona, 2013; Piovesan & Wengström, 2009; Rand et al., 2014, 2012). Findings of these studies yield inconsistent results, with some studies concluding fast reactions are prosocial and others concluding they are not. However, studies that manipulate the cognitive mindset, for instance through evoking intuition or reflection, favor the conclusion that intuition brings about prosociality and honesty (Rand et al., 2014, 2012; Zhong, 2011). It is therefore important that future research that aims to answer questions of whether people will automatically act in a selfish way—whether that means being dishonest or choosing not to cooperate—addresses these questions while examining various amounts of cognitive processing.

Additional insights on this issue could come from further empirical clarification on the different effects of manipulations such as time pressure and cognitive load. For instance, questions of whether these manipulations differentially affect processes like self-serving biases and relying on heuristics could be addressed. Time pressure may elicit a 'hot' affective response that is motivated by immediate gain. Likewise, under time pressure heuristics are often resorted to (Finucane, Alhakami, Slovic, & Johnson, 2000), and certain situations may make the mental short-cut 'more money is better' more salient than 'honesty feels good'. Yet arguably, these processes still take up some amount of cognitive effort, and therefore a manipulation of cognitive load could interfere with, for instance, a self-serving bias. Research by Valdesolo and DeSteno (2008) suggests that this may indeed be the case. When their participants were under high cognitive load, a self-serving bias that is typically observed in the hypocrisy literature disappeared. Where normally people judge moral transgressions performed by themselves more fair than transgressions performed by others, these participants judged a moral transgression performed by themselves equally unfair as when it was performed by another individual. This suggests that cognitive load can indeed interfere with a self-serving bias.

Effort and self-serving biases

The question of whether dishonesty is driven by an automatic self-serving bias can likewise be examined with a focus on cognitive effort rather than time. Although the die rolling task described in Chapter 2 has several important qualities, such as its anonymity, it does not lend itself well for this question. What this task does is determine whether people are dishonest. What it does not do is provide evidence for which cognitive process led to this dishonesty. Was it due to self-serving biases that arguably take up some cognitive effort, or was this dishonesty a result of more controlled calculations and deliberation? In an attempt to test the boundary conditions of self-serving tendencies I therefore ran two experiments using cognitive load and a 'dot task'. This task can be used to reveal dishonesty stemming from self-serving interpretations (Gino & Ariely, 2012). It works as follows. Participants are asked to indicate on which side of a diagonal line dividing a square on the screen they see more dots. To reward them for their effort, they are paid 5 euro cents for each trial on which they indicate seeing more dots on the right, and 0.5 euro cents for each trail on which they indicate seeing more on the left. The dots are displayed for one second, after which the participant chooses to indicate "more on the right" with the M key on their keyboard or "more on the left" with the Z key (Mazar & Ariely, 2009). This difference in payment is meant to present the participants with a choice to either be accurate or to increase their payment.

Figure 7.1 displays two examples of a trial in this task. Although participants are presented with trials in which the dots are seemingly randomly displayed on either side of the diagonal line, a distinction can be made between trials on which the correct answer to the question "Are there more dots on the left or more dots on the right?" was very easy to detect because there were clearly more dots on one side then the other (e.g., 6 vs. 14 dots) and trials where the correct answer was more difficult to detect (e.g., 9 vs. 11 dots). Participants thus have an opportunity to serve their self-interest by lying in a clear situation (see also Mazar & Zhong, 2010) and an opportunity to serve their self-interest by lying in a more ambiguous situation (see also Gino & Ariely, 2012). Because people are generally

averse to lying (Gneezy, 2005), I expected participants to only serve their self-interest on trials for which they could make use of the ambiguity of the situation (not unlike the situation in which no one but yourself knows the outcome of a die role). Furthermore, if being selfish takes some cognitive effort, it can be expected that participants would display this bias only when they have enough cognitive capacity to do so.

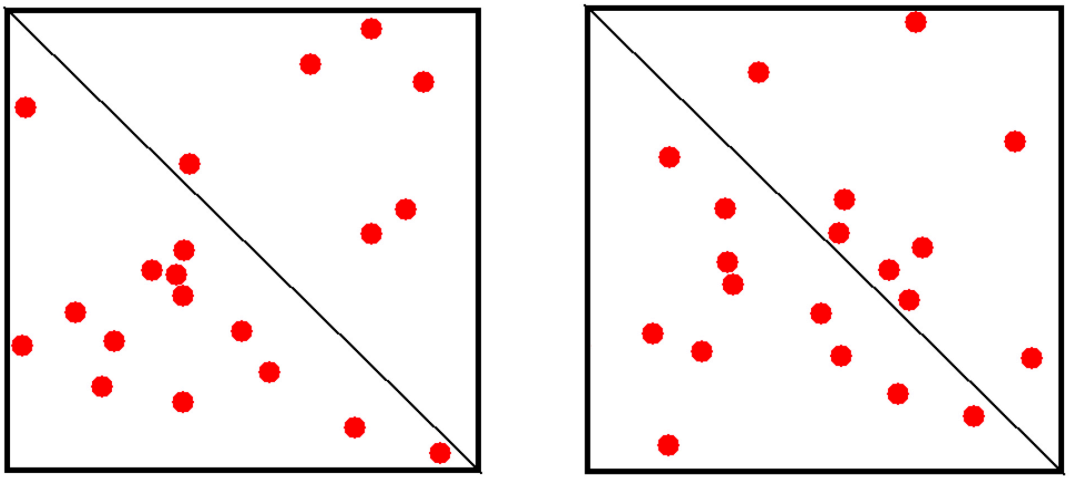

Figure 7.1. An 'easy' trial (left) and an 'ambiguous' trial (right) in the Dot task. One hundred trials present a seemingly random amount of dots for approximately one second after which participants have to choose on which side they saw more dots. Choosing the right side earns ten times as much money as choosing the left. In the examples depicted, the correct answer is to choose the left side.

In a first study to test these expectations (N = 177), it was indeed the case that participants were dishonest mostly on the trials where the ambiguity of the situation allowed for creative re-interpretation. In other words, on the ambiguous trials participants chose to see more dots on the side that earned them more money. More importantly, we observed a drop in this behavior in a condition where participants were under high cognitive load. This would suggest that even a bias that pushes people to be self-serving in a split second decision could take additional cognitive effort. However, in a

pre-registered attempt to replicate these findings (N = 254), this latter effect disappeared: in this study, the tendency to serve self-interest on ambiguous trials was not decreased under load (see supplemental material, Study 3 and 4). It is therefore too soon to draw far-reaching conclusions about whether self-serving biases that lead to dishonesty take cognitive effort. Some authors have likewise found indications that cognitive load can indeed interfere with self-serving biases (Valdesolo & DeSteno, 2008), whereas others have even suggested that selfishly deceiving oneself is an covert automatic process, namely one that has evolved to make deceiving another person less effortful (von Hippel & Trivers, 2011).

Emotions and honesty

Intuitive processes that influence moral judgments and decisions may not always register consciously, yet they often involve general feelings that signal whether something is positive or negative. For instance, the act of deceiving another person may be accompanied by negative feelings of guilt. These feelings in turn are accompanied by visceral states associated with negative arousal. This is supported by research showing that there is more physiological arousal when immoral actions are actually performed, compared to when they are merely forecasted or not performed at all (Teper, Inzlicht, & Page-Gould, 2011). Studies of patients with damage to the ventromedial prefrontal cortex reveal that—despite reasoning abilities being intact—a lack of integration of this somatic experience can lead to anti-social behavior (Bechera, Damasio, Damasio, Anderson, 1994; Damasio, 1994). These patients have to rely on a reasoned cost-benefit analysis of the available options, and consequently often choose disadvantageously. In similar vein, when people misattribute their visceral state to something other than the moral decision at hand, this seems to make them more inclined to act immorally (Dienstbier, 1972; Dienstbier & Munter, 1971; Teper, Tullett, Page-Gould, & Inzlicht, 2015). In other words, if the function of emotions and somatic states to signal the wrongness of certain behavior is misaligned, this behavior is not avoided.

In keeping with the above, a complementary method to manipulating cognitive capacity is to manipulate emotional states. Emotions have an important influence on decision-making (Loewenstein, 1996; Loewenstein, Weber, Hsee, & Welch, 2001; Zeelenberg, Nelissen, Breugelmans, & Pieters, 2008). Furthermore, being in a positive mood has been found to buffer against negative associations with the immoral option (Valdesolo & DeSteno, 2006) and to increase cognitive flexibility (Isen, 2000). This flexibility may in turn allow for more dishonesty (Gino & Ariely, 2012). Therefore, it can be argued that when people feel positive, they would more readily 'deceive themselves' by categorizing a self-serving dishonest response as an honest response. This may require some reasonable doubt or ambiguity about what the correct response is; it is in these cases that a little flexibility allows for re-interpretation. I tested this idea by employing the above-mentioned dot task (See Gino & Ariely, 2012) after inducing happy, sad, or neutral feelings in participants (N = 171) via film clips. Results of this experiment indicated that neither in the positive nor the negative or the neutral mood condition there was a higher tendency to be self-serving (see supplementary material Study 5). In these cases, however, a possible explanation for this finding could come from the fact that feelings of the internal reward of being honest and the external monetary rewards interact (Mazar & Ariely, 2006), and thereby possibly cancel each other out. Together with recent work that argues that there is a lack of empirical research examining the effects of emotion on actual moral behavior (Teper et al., 2015), this stresses the importance for future research to further disentangle the role of emotions and their influence on cognition in producing dishonest behavior.

Effortless enduring guides to honesty

In this dissertation, a further focus was on people's ability to discern dishonest intentions in others. Differences in this ability were examined for judgments that are more or less effortful. Research on detecting deception has focused mainly on consciously made direct veracity judgments (i.e., Is the other person lying?). Yet, as meta-

analyses have shown, these judgments do not seem to enable people to correctly deduce whether another person is lying or telling the truth (Bond & DePaulo, 2006). More recently, several indications have emerged that suggest that indirect judgments, such as judgments about another person's demeanor, are better able to distinguish lies from truths (Ulatowska, 2014; Vrij, Edward, & Bull, 2001). Aside from this, theoretical accounts hold that people have a fundamental—survival promoting—automatic ability to determine whether another person is friend or foe (Cosmides, Barrett, & Tooby, 2010; Fiske, Cuddy, & Glick, 2007). This ability reflects itself in judgments of the likability and trustworthiness (i.e., warmth) of others.

In Chapter 3 these theoretical notions about affective impressions of others were tested in the realm of deception detection. The robustness of various veracity judgments was tested by varying another aspect of a deceptive interaction, namely whether (dis)honest stories are spontaneous or rehearsed. As was shown in Chapter 2, being dishonest requires more cognitive effort than being honest. This effort, in turn, may make it easier for others to detect that they are being deceived (see also Vrij, Fisher, Mann, & Leal, 2008; Zuckerman, DePaulo, & Rosenthal, 1981). Rehearsing a dishonest story may make telling the story less effortful, whereas rehearsing an honest story may not have such benefits. Indeed, it was revealed that people expect to be better able to detect deception from spontaneous, unrehearsed stories. Importantly, Chapter 3 also provided empirical evidence that validated this expectation. Next to this, this chapter presented initial evidence for the merit of affective indirect veracity judgments by showing that while the direct as well as most of the indirect veracity judgments no longer discriminated between liars and truth-tellers when stories were rehearsed, participants' affective indirect veracity judgment remained a valuable guide in dishonesty detection. This underlines the importance of the effortless impressions people form of others.

Implications

Chapter 3 also adds to the literature on deception detection by suggesting that it is important to take into account the spontaneity of stories when trying to identify whether another person is lying. The indirect veracity judgments examined in this chapter that asked about the ease of expression of the target indicated that retelling a story makes the storyteller come across with more ease. As mentioned above, when a liar experiences more cognitive load this can help observers detect deception. Together this suggests that if retelling a story indeed takes less cognitive effort, this makes correct detection less likely. This can have important implications for more applied settings where, for instance, statements are used that may have been rehearsed or that are retold on several occasions. Although the research in this dissertation was not meant to directly advise professionals in applied settings, the results provide an important step toward fully understanding the impact of, for instance, how law enforcement officers and judges perceive a suspect.

Additionally, it is valuable to take the spontaneity of stories into account when studying people's ability to detect deception. Although in Chapter 3 the direct veracity judgment did discriminate between liars and truth-tellers when stories were spontaneous, it did not do so when their stories were retold. This latter pattern resembles the lack of ability to detect deception revealed by meta-analyses (Bond & DePaulo, 2006). Future investigations are therefore advised to take into account both the conditions under which veracity judgments are made (i.e., whether the observer is asked to judge veracity directly or indirectly) as well as the conditions under which targets tell their story (i.e., whether it is rehearsed). Furthermore, it is important to provide sufficient details about these latter conditions in order for others to be able to evaluate them.

Reliance on effortless modes of processing

In Chapter 4 a stress manipulation was employed to examine people's ability to detect deception in a situation that calls for reliance

on effortless modes of processing. Stress triggers neural responses that permit an adaptive and fast response to the situation. This is often referred to as a 'fight-or-flight' response (Cannon, 1914). It has been suggested that under stress people rely more on automatic instead of controlled effortful processing (Keinan, 1987; Schoofs, Preuss, & Wolf, 2008; Starcke & Brand, 2012). Being stressed thus seems to hinder deliberation. In the area of deception detection, research has found that people have higher deception detection accuracies when their ability to deliberate is impaired due to concurrent cognitive load (Albrechtsen et al., 2009). Furthermore, in a stressful situation it may be especially important to know whom to trust. It is in these cases that it is of vital importance that cooperation and affiliation efforts are directed at others who will likely reciprocate. Chapter 4 therefore focused on people's ability to discern (dis)honesty in the kind of situation where sharpened senses are vital—under stress.

In this chapter trustworthiness detection was studied with the use of dynamic video material. This is relevant because there are several indications that dynamic, rather that static, information about another person holds the key to the detection of trustworthiness. For instance, it has been argued that the features that make a neutral face trustworthy resemble emotional expressions, and that therefore the ability to detect trustworthiness from a neutral face is present as an extension of the ability to read emotional expressions (Oosterhof & Todorov, 2009; Todorov, 2008). Although this suggests that there is merit to the study of character from the permanent form of facial features—an area called physiognomy—it does not take into account that the same person may be dishonest in one situation, and honest in another. In these situations, the nonverbal behavior that is expressed may be subtly different. Correspondingly, when Darwin studied the expressions of man and animals, he was interested in the expressions associated with a certain state of the mind, not the physiognomy that Lavater had described earlier (Darwin, 1872/1998).

Even though it seems fundamental to the study of people's ability to infer the trustworthy intentions of others to take into account the others' state of mind, its importance is currently undervalued. In studies on trustworthiness detection, the use of still pictures of neutral faces is plenteous (Bonnefon, Hopfensitz, & De Neys, 2013; Stirrat &

Perrett, 2010; Todorov, Pakrashi, & Oosterhof, 2009; Todorov, 2008; Willis & Todorov, 2006; Winston, Strange, O'Doherty, & Dolan, 2002). Even so, people seem to perform better at detecting trustworthiness from pictures that are taken in the moment a target decides to betray trust (Verplaetse, Vanneste, & Braeckman, 2007) compared with neutral pictures of a face (Bonnefon et al., 2013). Indeed, it seems a combination of non-verbal behaviors displayed by an interaction partner predicts trustworthiness (e.g., DeSteno et al., 2012). For this reason, in Chapter 4 the use of dynamic (video) material was stressed in order to further the discussion on people's ability to form effortless impressions of the trustworthiness of others. Indeed, it was found that truth-tellers were rated higher on trustworthiness than liars, especially so when the observers' senses were heightened due to being in a state of stress.

Consequences of effortlessly formed impressions of (dis)honesty

Just as the aforementioned intuitive factors can signal the valence of an action, evaluations of the positivity/negativity of others can also serve to prepare behavior toward this other person. Evaluations of valence are aligned with an approach/avoid response: people have automatic approach tendencies towards positively or potentially rewarding stimuli, and automatic avoidance tendencies towards negative or threatening stimuli (Chen & Bargh, 1999; Rotteveel & Phaf, 2004). These automatic tendencies to approach and avoid are among the most basic motivational systems associated with affect (e.g., Carver & Scheier, 1990; Elliot, 2006; Russell, 2003). As especially judgments of trustworthiness signal valence, these judgments are likely to serve the purpose of determining whether to approach or avoid another person (Todorov, 2008). Other indications that support this idea suggest that when people are asked to inhibit a response to certain faces, these faces are later judged to be less trustworthy (Fenske, Raymond, Kessler, Westoby, & Tipper, 2005). Furthermore, judgments of trustworthiness and approachability ("How much would you like to walk up to a person in the street to strike up a conversation?") are impaired in patients with bilateral amygdala

damage compared to controls (Adolphs, Tranel, & Damasio, 1998). This is consistent with the amygdala's presumed role in detecting threatening stimuli and promoting vigilance and attention under conditions of uncertainty, whereby guiding approach and avoidance behavior (Davis & Whalen, 2001). These findings suggests that a fruitful avenue for future research is to examine approach and avoidance tendencies in relation to honest and dishonest others.

Given the above, an alternative explanation for why findings in Chapter 3-6 suggest there is something that observers pick up about liars and truth-tellers might be that all judgments are simply more negative when observing a liar. Although findings in chapter 3 and 5 suggest this is not the case (e.g., liars were not judged to have less ease of expression, and they were not judged to be more deceptive), one might wonder whether next to a judgment of warmth, a judgment of competence—the other important dimension underlying person perception (Fiske, Xu, Cuddy, & Glick, 1999; Rosenberg, Nelson, & Vivekananthan, 1968)—is also negatively affected by deception. I therefore ran a study that asked participants to watch the 3-minute truth and lie videos from Chapter 5 and to provide a warmth and a competence judgment for each target, next to a behavioral intention towards them. The fact that half of the targets was lying when talking about themselves was never mentioned to participants. I asked participants whether (1) this was a person they would hire for a job, (2) whether they liked this person, and (3) whether this person appeared competent (see supplemental material, Study 6). This study was run online to get a relatively older sample presumed to be more experienced with a job interview setting ($N = 64$, $M_{age} = 35$). Although these findings therefore need further confirmation, results did indicate that when targets lied, they were less likely to get hired and also liked less. The effect for competence, however, was not significant. This confirms that there is more to impressions formed of liars than a mere shift in all judgments toward the negative.

These results are also in line with other findings that suggest that warmth is more important in forming impressions than competence (Wojciszke, Bazinska, & Jaworski, 1998), and is processed earlier and faster (Abele & Bruckmüller, 2011; Ybarra, Chan, & Park, 2001). Next to this, people use warmth more than

competence to seek out others they want to work with (Casciaro & Lobo, 2008). Because deception is frequently used in job interviews (Weiss & Feldman, 2006), this might be a situation where the automatically formed impressions are especially consequential. Moreover, it has been found that the frequency of lies told in a conversation is related to disliking and that people lie more to those who lied to them (Tyler, Feldman, & Reichert, 2006). Together these findings stress the importance of investigating the consequences that effortlessly formed impressions bring to those who chose to deceive another person. In many real life situations, the effect of liking another person just a little less may have significant consequences in the long run. Examples that come to mind include voting behavior, excluding or helping others, and choosing whom to cooperate with.

Indirect versus direct judgments of honesty

Combining the results of Chapter 3 and Chapter 4, these chapters provide evidence for distinguishability between honesty and dishonesty of others when affective indirect veracity judgments are made. In Chapter 5 and 6, one of the aims was to replicate and extend these effects. It has been previously argued that there is a lack of direct comparisons between the effects of direct compared to indirect veracity judgments (Levine & Bond, 2014; ten Brinke & Carney, 2014). Next to this, in Chapter 5 it is also suggested that typical studies don't allow for accurate comparisons due to the fact that direct veracity judgments are usually assessed with a binary yes or no question (i.e., 'Is the target person lying?') whereas indirect veracity judgments are assessed on Likert scales. In Study 5.1 both the direct and the indirect veracity judgments were assessed on a continuous scale, allowing for comparison between the two. Results indicated that again, truth-tellers were liked more than liars, while on the direct measure they were not judged to be more or less deceptive. This study thereby provided direct evidence for the superior ability of indirect veracity judgments compared with direct veracity judgments. Additionally, Study 5.2 tested whether either one of the affective indirect veracity judgments (liking or trustworthiness) was

superior to the other. Results indicated that the effect size for both these judgments was not significantly different. This suggest that these judgments—both previously associated with the effortless ability to perceive 'friend' or 'foe'—are equally well equipped to distinguish between honesty and dishonesty. Chapter 5 thus further adds to the literature by providing direct evidence for the superiority of effortless indirect—compared to direct—measures of deception detection.

Looking at the effort that is expended by the observer when making a veracity judgment, it also seems important to examine the influence of being forewarned of the possibility of deception. As discussed in Chapter 5, when participants know they have to detect deception, their attention may be shifted toward different cues. If the cues people use are not actual indicators of deception, this may lead to wrong veracity judgments (Vrij et al., 2001). Furthermore, it is reasonable to assume that being forewarned about the fact that deception may take place will recruit different mental processes, most likely those of a more controlled and deliberate type. Future research is advised to take being forewarned into account when examining how reliance on different cues affects direct veracity judgments. To further disentangle the effect of the effort that is used to make direct veracity judgments, an experiment could be considered in which effort is manipulated by asking participants to either 'go with their gut' when deciding whether another person is lying or to provide their reasons for this decision. Giving reasons for a decision can have detrimental effects (Halberstadt & Levine, 1999; Wilson & Schooler, 1991), and similar 'overshadowing' of the correct intuitions may happen when people are all too deliberately trying to detect deception.

Effortless physiological responses to dishonesty

Next to extending findings concerning the merit of affective indirect veracity judgments, the aim of Chapter 5 an 6 was to investigate whether correct intuitions about the (dis)honesty of another person reflect themselves in the physiology of the observer. In Chapter 5 finger skin temperature was measured because previous

findings have revealed the importance of temperature in trust and interpersonal relationships (e.g., IJzerman & Koole, 2011; IJzerman et al., 2012). Longer videos of 3 minutes were used to allow an effect of (dis)honesty to unfold over time. Results revealed temperature indeed seemed to be affected by whether the target was honest or dishonest. However, the reported experiments leave room for improvement. For instance, because targets in these videos had to make up a long story, their lies may have consisted of a gradient of untrue information. As we have seen, right out lies are difficult to come up with. Mixing in information that, for instance, happened to someone else may make lying easier, and it seems likely targets did this on occasion. In order to clarify the observed temperature pattern, a next step would therefore be to test the effect of dishonesty on the observers' physiology with liars that tell a continuous story out of their own initiative.

There are still a lot of questions to be answered by research in the area of thermoregulation as well as that of pupillometry. It is therefore too soon to be able to interpret the exact meaning of the findings in Chapter 5 and 6. Even so, the observed patterns warrant further investigation. For instance, for pupillary responses a clear pattern was observed: while participants were watching the targets' answer, their pupil diameter first showed an increase and then a decrease. It is likely that this reflects the response of someone who is watching another person giving an answer to the 'did you cheat' question. Importantly, this pattern was more pronounced when participants were watching a dishonest answer. In other words, when watching a target who lied, participants' pupil diameter showed an increase, more so than for watching a target who told the truth. This pattern could, for instance, be an indication of the detection of the presence of something unusual or unexpected. It could also be an indication of cognitive effort, as it may require more effort to process possible disfluency of the deceiver. Future research could verify whether these initial findings reflect the idea that observing dishonesty is, for instance, more effortful than observing honesty.

Findings of both Chapter 5 and 6 invoke an association with Damasio's (1994) somatic marker hypothesis. This hypothesis suggests that physiological states 'mark' the goodness or badness of

certain alternatives. These physiological markers may be present even before people become aware of, for instance, whether a decision to go with one option rather than the other is advantageous (Bechara, Damasio, Tranel, & Damasio, 1997). These markers involve physiological changes that constitute emotions and that, on a more conscious level, are perceived as "feelings" (Bechara & Damasio, 2005). When detecting deception, it seems that an increased reliance on conscious, deliberated judgments impairs detection abilities because a correct 'gut feeling' is overwritten or discarded by more effortful processing. Because of this, examining psychophysiology to reveal the process behind correct intuitions seems especially valuable.

In closing

The findings discussed in this dissertation demonstrate the benefit of looking at deception through a lens that emphasizes the cognitive effort that is exerted by both the deceiver and in the deceived. More specifically, this lens enabled me to show that while people may often show dishonest behavior—especially when this behavior can serve self-interest—this behavior occurs to the extent that enough cognitive capacity is available. Moreover, when judging other people's deceptive intentions, judgments that are made consciously yet that require little effort (i.e., indirect affective judgments) seem to be better able to tell honesty and dishonesty apart than more effortful considerations of whether deception took place. Being on guard can facilitate these effortless judgments—both a certain amount of vigilance (i.e., stress) and being forewarned of the possibility of deception can bring out correct intuitions. Finally, as I have suggested in this dissertation, correct intuitions about another person's honesty may stem from early unconscious processes that warrant investigation of physiological markers.

Research that emphasizes cognitive effort encounters both the remarkable capacities of the human mind as well as its frailty. In this dissertation I started with research that utilized the limitations of the mind in order to study deceptive behavior. Because the task of remembering a string of letters competes with other effortful processes, this allowed for a test of the effort it takes to be dishonest. The capacity to form an impression of another person, in contrast, seems to require no such effort; there is no need to memorize objective characteristics of another person in order to form an opinion about them. Discerning dishonesty in others, therefore, seems to be aided by effortless processes. By capitalizing on the effortful and effortless processes that characterize the human mind, I hope to have advanced the discussion on deception and the detection of it.

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Summary

This dissertation presents an experimental social psychological investigation of both deception and its detection with an emphasis on the role of automatic, 'effortless' processes. The work in this dissertation is connected to recent debates in moral psychology about the intuitive nature of prosocial and moral behavior, as well as to findings from the evolutionary, developmental, neuroscientific, and response time literatures. Building on the premises that successfully navigating the social world requires intuitive moral decisions and evaluations of the moral character of others, and that these judgments and decisions are often made under circumstances that are not well equipped for moral deliberation, three aspects of dishonesty were investigated.

First, cognitive effort involved in deceiving others was examined. Previous research that speaks to the question whether being honest or dishonest is the automatic tendency has resulted in mixed findings, possibly due to a focus on time as an indication of deliberation. Therefore, in this dissertation cognitive load, rather than time, was manipulated. Findings suggest that when enough cognitive capacity is available *and* people can serve their self-interest by being dishonest, they will often do so. Yet without this cognitive capacity, people are honest regardless of the fact that self-interest could have been served. This dissertation provides direct evidence for the prediction that being dishonest takes more cognitive effort than being honest.

Secondly, the work in this dissertation tests theoretical notions about people's ability to effortlessly form a correct impression of the

trustworthiness of another person in the realm of deception detection. Theories from different research areas suggest that people's impressions of others reflect an automatic ability to determine whether another person's intentions are good. This kind of skill would allow people to successfully choose cooperation partners and form coalitions with others who reciprocate when help is needed. However, well-established findings from the deception detection literature reveal that veracity judgments are often biased and wrong. A possible reason for this could be that when people make a judgment of whether someone else is lying, they deliberate too much. Therefore, in this dissertation people's affective responses towards (dis)honest others were examined. Unequivocally the (pre-registered) research in this dissertation reveals that whereas people are not able to distinguish between liars and truth-tellers when they are asked to judge veracity directly, their affective (i.e., liking, trustworthiness) judgments do favor a truth-teller over a liar. This was observed when participants were presented with a brief (dis)honest answer by a target about a transgression committed earlier, when presented with relatively longer stories told by targets who were lying or being honest about their personal life, and when liars and truth-tellers were well rehearsed and therefore came across with more ease of expression. Being on guard seemed to facilitate these effortless veracity judgments—both a certain amount of vigilance (i.e., stress) and being forewarned of the possibility of deception can bring out relevant intuitions.

Finally, several experiments in this dissertation were aimed at examining the previously unexplored physiological responses in the observer of (dis)honesty. The above-mentioned intuitions about another person's (dis)honesty may stem from early unconscious processes that can be reflected in a physiological reaction that marks the (un)friendly intent of others. Two different physiological responses within the observer of (dis)honesty were investigated. The first physiological response, finger skin temperature, reflects trust and unfolds slowly over time. The second physiological response, pupillary dilation, is a more fine-grained time sensitive measure of mental processing. Results revealed that people's physiology was differentially affected by the (dis)honesty of others. When people observed liars their skin temperature consistently dropped, whereas

when they observed truth-tellers this depended on whether they were forewarned about the possibility of deception. Additionally, when people observed a dishonest compared to an honest target, this evoked a greater pupillary response, even though the face area of honest and dishonest targets was monitored similarly. Together the findings in this dissertation demonstrate the benefit of considering deception through a lens that emphasizes the cognitive effort that is exerted by both the deceiver and the deceived.

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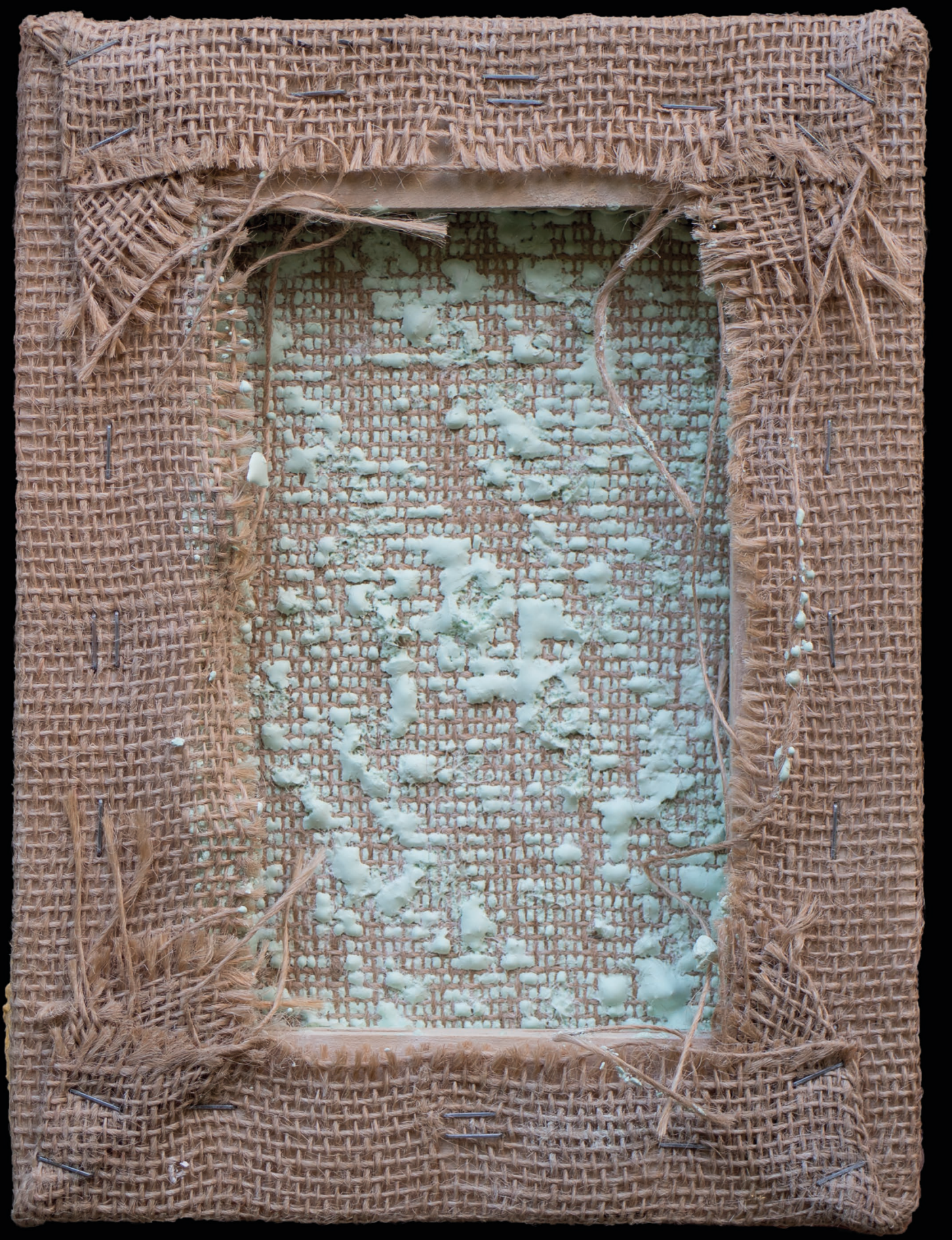

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